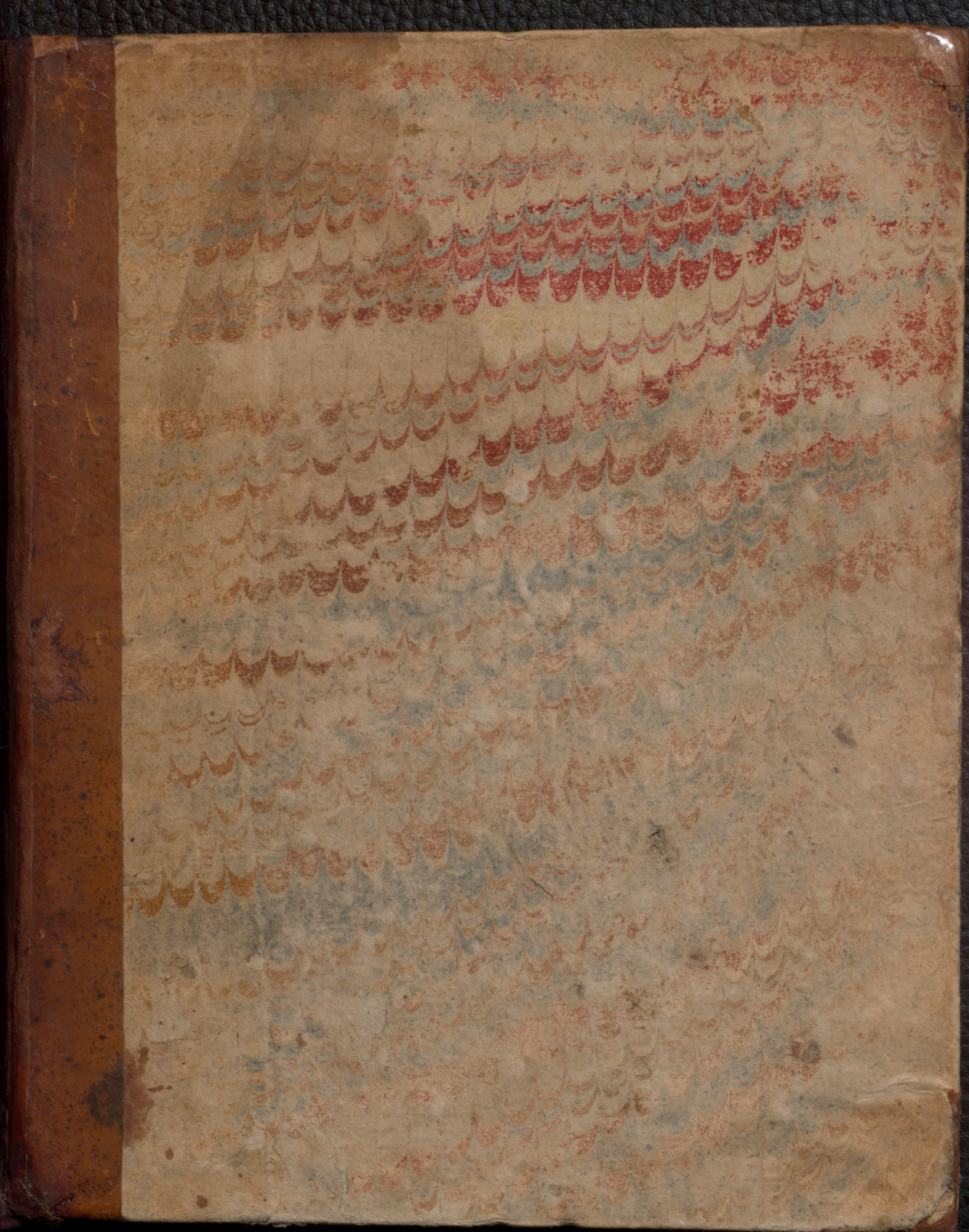
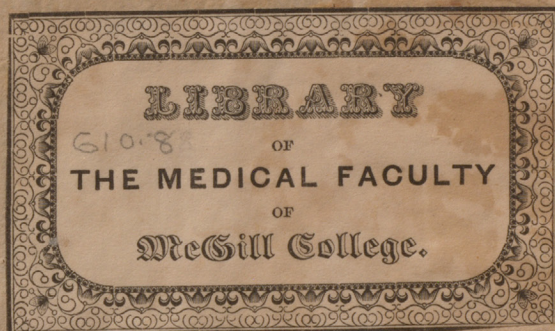




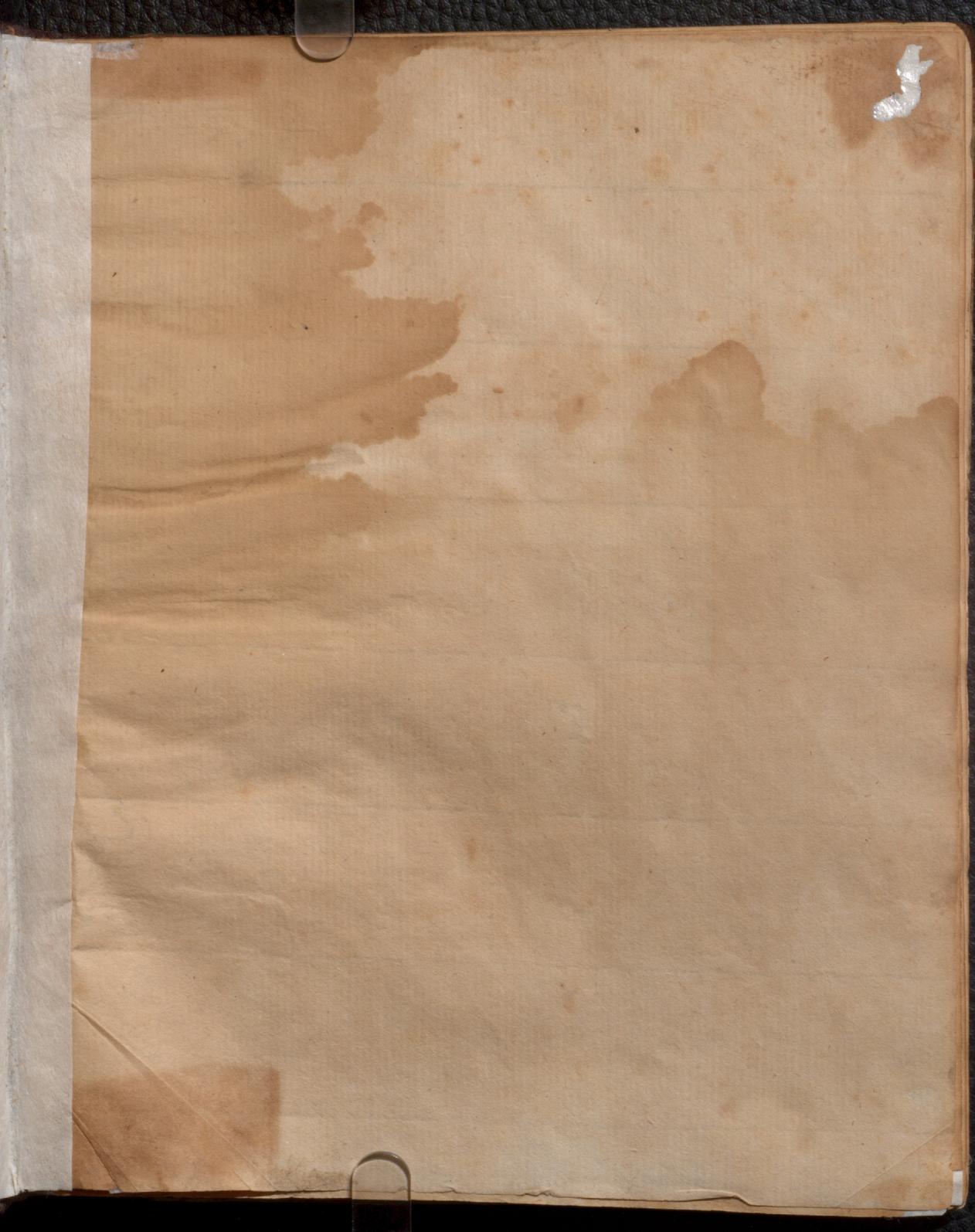




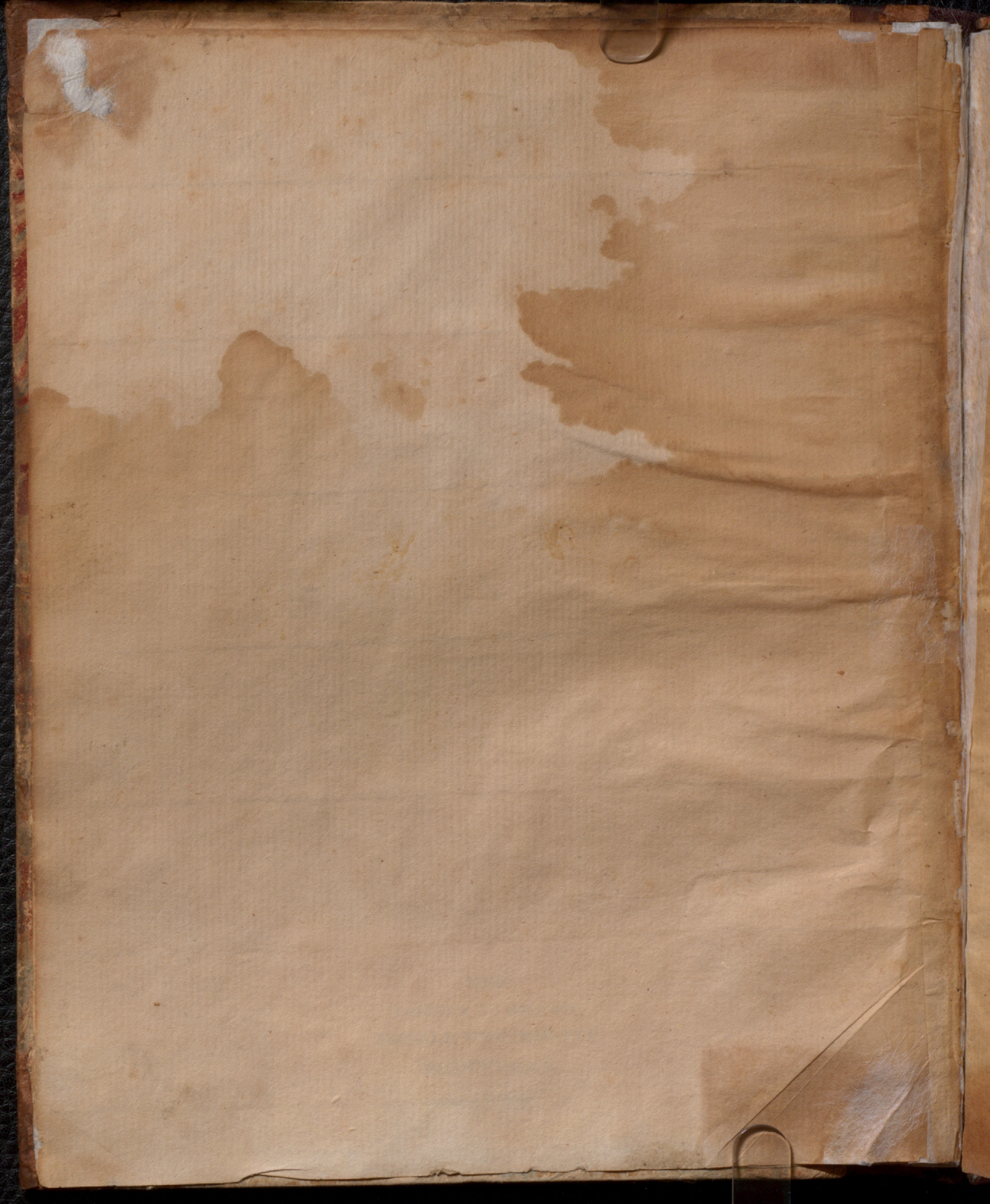
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# Anatomical Lectures

By

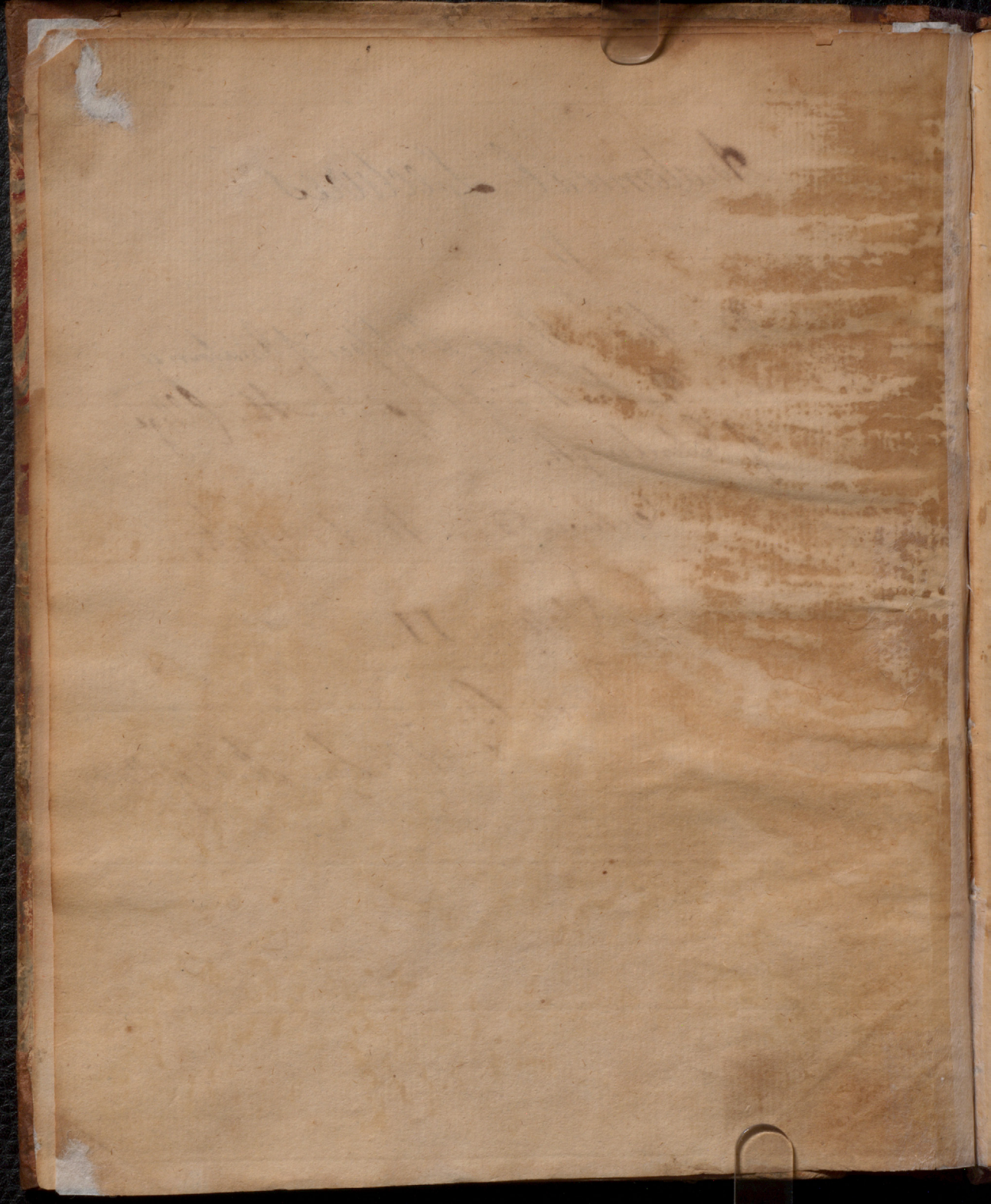
Dr. Alex. Monro, Professor of Anatomy  
and The Practice of Physic in the College  
of Edinburgh.

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Volume II.

Whose By Robt. Sympson M.D. of Medicine







Sept. 16<sup>th</sup>

When speaking of the Luxations of the  
Spine, I put entirely out of Question those  
which may happen more readily at y<sup>e</sup> top  
of the Neck, where the connections are  
particular. You can readily judge of the  
way in which the Luxation will  
most readily happen here — We find a  
case of this kind thus described by Petit.  
A Man lifted a boy from the ground by  
the Head, or lifting him so He was insensible  
and died in a few minutes, but the Boy  
had struggled at first. There was no  
Dissection, but it is probable that by the  
Weight of the body, the second Vertebra was  
drawn away from the First, that the  
Perpendicular Ligament, which ties the  
point of the Tooth-like process to the  
head had been much relaxed or lacerated,  
so that the point came to be lower  
than



than the Transverse Ligament<sup>th</sup> prevents  
 its motion backwards on the Medulla, and  
 perhaps by the struggle this perpendicular  
 Ligament being tore & the other relaxed, the  
 Oblique processes of the 2<sup>d</sup> Vertebra might have  
 slipped off from the Oblique processes of the 1<sup>st</sup>.  
 Next we find a few examples in Authors  
 where luxations have happened hereby  
 a fall. The 2<sup>d</sup> Vertebra slipping off from its  
 1<sup>st</sup> & compressing or even tearing the  
 Spinal Marrow. Now in such a case what  
 method are we to take for a reduction?  
 Oppenheim's the evident one will be this.  
 We do not barely endeavour to push the  
 head back into its place, but we first make  
 the necessary operation. Taking hold of  
 the Head and making the resistance with  
 our knees on the Shoulders of y<sup>e</sup> Patient,  
 Shelt. the parts or else and then give the  
 proper situation. It has been alledged  
 that such luxations have been frequently  
 cured



used in this way, as in the case of Two  
 Persons of High rank in this Country, They  
 fell from Hasebacks, were insensible, but soon  
 after such an attempt recovered. Now the  
 Question is, If They would have recovered  
 whether this attempt had been made on  
 Not, That from the Fall They had  
 been only stunned as in the case of a  
 Blow on the Head. The Way to Judge  
 in such a case is, To Try the Motion of ye  
 head, before We begin any extension,  
 and if You can turn it to the proper  
 situation, the Patient is only stunned,  
 and an extension would be most full.  
 But if You find a resistance, from the  
 Catching of the Oblique psoepus, then  
 the Operation is absolutely necessary.  
 Want of attention to this circumstance  
 has made People believe That such  
 Situations are more frequently present  
 than they really are — and there is  
 another circumstance which has led  
 into the same mistake. The



The Spine is frequently said to be located, where tumors have formed with a distortion of the body, & that owing to a gradual growth, so that by a proper attention to the circumstances of the case, the Surgeon might have made a distinction readily. If the tumor & Distortion be owing to a Dislocation, we can trace it back to some violent cause, and the Patient is usually able to raise his own body, nor can the body be straight by another. Whereas a Patient may be beat down & the legs become Paralytic from an Affection of the Spinal marrow, tho' no dislocation has taken place, The Pain occasioning an Inflamm<sup>n</sup> and the tumor forming in consequence of this. But further, these tumors occur not only independent of any external injury but independent likewise of any Disease to which we can give a name, and they are often highly dangerous. I have more seen about 10 or 12 such tumors which have formed in the Spine, some of



them I could trace from a Rickety Habit,  
 in others there was evidently a syphilitic  
 taint, In one case there was the Scars & a  
 but in all the others, the disease seemed  
 absolutely local, the Patient having no  
 other complaints. Of the Member I ment<sup>d</sup>  
 I could only trace the history of 6 or 7 the  
 rest being only poor People that I saw  
 but once or twice at the utmost.  
 of that Member, in 3 the disease proved  
 fatal by affecting the spinal marrow.  
 The symptoms were at first a Burning  
 Heat & pain about the part, before we  
 could distinguish any degree of swelling.  
 But at length the tumour became very  
 distinguishable by the hand, and the  
 Patient suffered violent shooting pains  
 which extended downwards to the lower  
 extremities. In some cases, these pains  
 were the first complaint, and the tumour  
 discovered some time after so that they  
 were taken for Rheumatic pains. The



291. They increased to a most alarming degree, so  
that they were not able to turn themselves  
in bed, but lay for several days without  
attempting the smallest motions. The  
Pains were succeeded & often accompanied  
by a degree of Weakness, & then by a degree  
of Palsy. The Pulse became quicker & smaller  
and the Disease ended at last fatally.

In one of the cases I had the opportunity of  
examining the body, & I found the Spine  
considerably distorted & the Canal for the  
Spinal Marrow much thickened. There  
was a growth & rheumoid, & a manifest  
erosion of the bodies of the Vertebrae, &  
of the intermediate cartilages, to such a  
degree that we saw into the Canal of  
the Spinal Marrow. In another case  
I saw no such Conspicuous, as I expected  
the Canal was not so much opened,  
but the Membranes between the bone  
and Spinal Marrow were considerably  
thickened, & had a purple colour.



Different from the Natural. Now after We  
 have described this complaint, is there any  
 observation w<sup>ch</sup> regard to the manner of treat<sup>t</sup>  
 or cure that is worth the making? I formerly  
 used to say that I had tried various courses  
 of medicines, where I have suspected Scroph<sup>u</sup>  
 I have used Sea Water, with Saline Purg<sup>es</sup>  
 and Mr. Park. I need say nothing of  
 the Venereal Disease, where Mercur<sup>y</sup> was  
 indicated. In other cases where only ye  
 Tumour appeared I tried the fluid alone,  
 or join'd with Mercur<sup>y</sup>, and I used to say  
 that the Mercur<sup>y</sup> had more effect than  
 any other medicine. I have since had  
 an opportunity of pushing its use still  
 further, in a very remarkable case of that  
 kind which I alluded to with Mr. Wood.  
 The Man was about 40, Well made and  
 Healthy. He offend the Tumour about 10  
 Months before we saw him, and the  
 Disease had come to such a height, that  
 He



293. That He was ever afraid to turn his arms  
in b. d. Besides the ones I have mentioned  
in every one of these cases a Special Discharge  
was made by Leeches, Blisters or Issues  
put in parallel to the spine. Thro' just  
3 or 4 Weeks after He began the Mercury  
there was no sensible amendment, but  
continuing to treat him as if it were the  
Venereal Disease, the Symptoms began  
to abate, and in about 10 Weeks they  
went all off, only the Tumours remain'd  
distinguishable, but not so big as before.  
As a Proof of his amendment He went  
thencewards to Glasgow in one day &  
continued well for six months. I have  
had a Letter lately from him, informing  
Me that the pains have returned, so  
I propose again to try the Mercury.  
It seems therefore to be more worth while  
to push this than any of medicine I  
yet know. Having now fully exam-  
the



294

The Structure of the Trunk, we proceed to 4<sup>th</sup>.  
False Vertebrae. It is of consequence to  
remark that there is the utmost variety  
in the appearance of the Spinal process  
of the Os Sacrum. In gen<sup>l</sup> we find  
three, & they gradually grow shorter, as if  
they had been long they would have  
pressed upon the soft parts in sitting  
down, and the last three are only covered  
with tough membranes instead of bone,  
so that in all Cuts, wounds with  
sharp pointed instruments near to the  
end of the Sacrum may be attended with  
very dangerous consequences, and it  
happens not unfrequently that a opening  
extends a great deal further up than usual  
there being in some cases two, & in others  
only one Spinal process, and in the Os  
Sacrum of a young Subject<sup>h</sup> I have  
here, the Spinal process is the whole  
length of the Sacrum, except its uppermost  
piece



295. *Spine*, the three pieces w<sup>h</sup> compose each vertebra running together sooner than ye different pieces join each other.

Now this circumstance of the opening in the Os Sacrum leads me to speak of a Disease in which the whole Spine is concerned, but particularly the lower part of it. Viz. the *Spina Bifida* so called, from the Spinal Processes being split into two parts. The fact is that tumors form in the back and lower part of the Spine, about the top of the Os Sacrum. These contain a fluid & communicate w<sup>th</sup> the cavity of the Spinal marrow, and they have much a soft covering as there is a want of the Spinal process. I have examined these tumors in two subjects by dissection, & the appearance of the complaint is very particular. It is generally born with us, but, & times after birth increases quickly and the colour is diff<sup>t</sup> from that of y<sup>e</sup> neighbouring parts.



296.

being of a Brown colour like the inside  
round the Nipple of Nipples. and the  
skin is much thinner at first, tho' in y<sup>e</sup>  
end it inflames & ulcerates & becomes more  
opaque. The Thin & transparent humours  
contains at first Water, or that mixed w<sup>th</sup>  
serum, but by the stretching the skin  
inflames is reddened and thus is formed.  
Now w<sup>e</sup> regard to the nature of y<sup>e</sup> Comp<sup>t</sup>  
Those who have seen the head dissected, and  
know that there is a liquor which covers  
the outer surface of the Pia Mater and of  
course that there is a space from y<sup>e</sup> head  
into the spine, between the Arachnoid sheath  
made by the Dura Mater, & the External  
covering of the Pia Mater will conceive  
that a Drop may upon the other side of the  
Arachnoid may fall down into y<sup>e</sup> spine  
and of this we have some instances by  
Ruysscher that I would observe no thing  
further, 1<sup>st</sup> In almost every case I have  
seen, I had one reason to suspect Hydrocephalus,  
In



297. In the two cases which I described, the Tumour  
was confined to the parthand had no communication  
with the rest of the Spine; and in both cases  
the Water was collected, not in the back of the  
Spinal Marrow, but towards its fore part.  
So that the chord was pushed out, and it  
made the back part of the Tumour with the  
Pegmennt. So We should be very cautious  
now We attempt to treat such Tumours, nor  
can We hope to succeed, for, as when We  
take off pressure from the Brain suddenly  
there is Danger, the case is the same here;  
then the Tumour necessarily, success of the  
letting in of the air, and you are to attend  
to the immediate danger arising from the  
distraction of the Spinal marrow. That the  
Surgeon by his procedure may expose Death  
in upon it. May generally where a Tumour  
has broke off itself the Patient afterwards  
Dies. So We should avoid as much as  
possible the opening such Tumours.

We next consider the 1<sup>st</sup> foreleg, or  
there is bones connected to the Sternum below  
which



where the Spinal Marrow goes out. Each of  
 these bones has a certain Degree of motion, but  
 the principle part of the motion is That of the  
 Three last pieces on the First, in the other pieces  
 it becomes less, & in the last Piece it is often  
 completely ossified. Now this motion is surely  
 of some little use in Delivery - Dr. Smellie  
 indeed tries to prove That this motion is  
 of no service, because Women have been  
 safely & easily delivered, where this Bone  
 has been found completely ossified, But it  
 only follows from this, That the Pelvis was  
 otherwise large enough for the purpose, &  
 surely as this part performs motion, its  
 yielding back must be of great use, and  
 where the Pelvis is narrow & this part is  
 ossified it must render the Labour somewhat  
 difficult or tedious.

Lect. 17<sup>th</sup>

To the Bones before we must add the  
 two bones commonly distinguished by the  
 Name of Ossa Innominata, i.e. Their figure  
 is



299. is so irregular that the Anatomists not finding any common substance to compare them to, have called them The Bones without a name. We may perhaps compare them to our figure of 8. But when you look for a description of the parts of these, Anatomists deviating from their common rule, of regarding appearance of the Bones only in their most perfect state, speak of them as they occur in a young subject. When the Ossification begins in these places. So they call them Gra. Max. Ischia & Pubes. This Division into three parts generally continues till about 14 or 15 years of Age, and sometimes much longer. The Socket for the Thigh Bone or Acetabulum is composed of these 3 Bones, the Ilium and Ischium form each about  $\frac{2}{5}$  of the cavity, and the remaining  $\frac{1}{5}$  is formed by the Pubes.

Leet. 18<sup>th</sup>

After seeing the general structure of the Pelvis, we are prepared for making the comparison between the Male & female skeletons, but altho we cannot see differences in



in all the bones, yet those which chiefly  
 merit our Attention are those which support  
 the Pelvis, and which admit of great application  
 in Practice. As Women are more sedentary  
 and are evidently by Nature prevented from  
 being equally active with Men, so we find  
 That the Texture of the body is every where  
 more lax, has less strength, firmness and  
 toughness in the several parts, and they  
 are both shorter, & smaller in proportion—  
 Next, as we shall afterwards find That ye  
 pressure condenses the Bones, promotes the  
 Ossification, both in beginning & continuance, so that  
 we more frequently find unusual openings  
 between the different pieces of Bones in Women  
 than in Men. Hence pursuing ye same view  
 the Sutures of the Cranium in Men are sooner  
 obliterated, so that the Cavities we were  
 given when speaking of the Sutures are  
 more to be attended to. On the same  
 account from the Weakness of ye Muscles,  
 their small Degree of action, the points of  
 the Muscles are better seen in a Male,  
 so



301. So that when we want to point out the origin & insertion of Muscles, we prefer the Male To the Female Skeleton. And where the Muscles have the effect of drawing the ends of any bones nearer to each other, we observe that effect better in the Male. And viewing the Heart as a Muscle, we are led to another observation, That the Ribs made by the blood Vessels are less of a curved Women, while the arteries in Men sink deeper, which renders the Dangers in Respiring greater in Men than in Women. But, a chief Difference to be attended to is the Pelvis. or the Body as intended for propagation of Children. Perhaps I might mention a Remark made by Buffon, which appears very probable, tho' I have never examined it. That the Thorax in Women is deeper, i.e. the Distance between the Back & Breast is greater, so that when the Motion of the Diaphragm by the Distension of the Lungs, is confined, a small play of the ribs has more effect in enlarging the Cavity of the Thorax.



292.

Thorax, and Malleages that we are not deceived  
here by the size of the Mammarys.

Let us now then, attend very exactly to the shape  
of the Pelvis, and the size in the two sexes. I have  
alleged in a general way That the Bones are  
smaller in all their Dimensions, That their Diameter  
is less in Females, but here we find a manifest  
exception to this rule, & which, the Statuaries  
and Painters have long ago observed. For without  
regard to proportion the Pelvis of the Female  
is larger than that of the Male. When we  
compare the Shoulders w<sup>th</sup> the Pelvis in a  
Well made Man, the proportion is nearly what  
the Painters suppose, the Distance from the  
top of the Shoulders to the breadth of the  
Pelvis is as 3 to 2. But I doubt if these  
proportions in the Female are to be reversed.  
That the breadth of the Pelvis is to that of  
the Shoulders in the same proportions.  
The Painters seem to exaggerate here, But the  
Pelvis without any regard to proportion is  
larger, so that Women take more room in  
sitting than Men do, and the Width is by no



no means owing to the Coasts, Now Thus see  
 on what it depends. 1<sup>st</sup> The Uter. Jea. spread  
 out wider, not entirely, to support the Uterus  
 better, when it is fully distended, but because  
 Nature studies to give a greater proportion to the  
 Abdomen, as well as to the Throat. That when  
 the Uterus ascends, the Abdominal Muscles may  
 be more easily lodged, by a slight extension  
 of the parts. Next, when we attend to the  
 Position of the Pelvis, We observe that when  
 the body is in a sitting posture, or placed  
 erect, the top of the Pelvis is not horizontal,  
 but oblique, or That the top of the Sacrum  
 is about 3 inches higher than the Uter. Pubis.  
 The Uterus has more of the oval shape in a  
 Female, and in a Man it is more circular,  
 so comparing the Uterus in the two sexes  
 with the head of a child, the shape in the  
 Female answers much better.

We next attend to the size & situation  
 of each part, and we find that the two  
 Bones bear each nearly its proportion  
 That



That the greater Circumference does not  
 depend on any particular piece alone being  
 larger, But 1<sup>st</sup> The Os Sacrum, is larger, and  
 broader, and in the manner the Distance  
 from the Sacrum to the Symphysis Pubis is  
 greater. Next, in the recent subject, there is  
 a remarkable Difference in the Thickness of  
 the Cartilage, of the Ligaments, & Aponeurotic-  
 Cartilaginous substance by which the Os  
 Pubis are connected, again, at the lower part  
 of the Pelvis, when we compare the two  
 openings, the Difference is perhaps in fact  
 greater than it is above, For 1<sup>st</sup> The Sacrum  
 in Women goes further back than in the  
 Male, is more hollow, and comes much more  
 forward in the Male. Next, the Os Coccygis  
 is connected remarkably lower, Has much  
 more motion the Cartilages are weaker and  
 softer, so that you may consider this part  
 as away, because without disjoining it,  
 it can be pushed quite back, in such  
 a degree, that there is a sexual motion equal  
 to



to  $\frac{3}{4}$  of an inch in every common Delivery.  
 I have opened the Vagina of the  $\sigma$  Sacrum  
 outwards, and next You will notice the size  
 of the Notch in the Ilium, how very much it  
 is larger in the Female. Now Consider the  
 effect of this, That by increasing the Arch, the  
 Ilio Pubis are pushed to a much greater distance  
 from the Sacrum, & from each other, so that from  
 this circumstance the breadth of the Pelvis is  
 greatly increased. Next, on the fore part we  
 observe another circumstance, which is not  
 sufficiently attended to, viz. The greater size  
 of the Foramen Hyagordium, so that where  
 the  $\sigma$  Sacrum & Pubis join, they form a  
 greater circle. Next, the cartilage between the  
 Ilio Pubis is thicker & likewise softer, and  
 taking the side view the Cartilage is not  
 so deep as in the Male. Lastly, You remark  
 that the Ilio Pubis in the Male join at  
 an acute angle, while in the Female  
 the angle is much wider, very near to a  
 right angle, Hence upon the whole the



The Dimensions are considerably greater, and  
I repeat it, greater below than above.

Now next, Let us with Dr. Smellie, who was  
the first perhaps who wrote sensibly on this  
particular subject, view a little the depth of  
the frons, and compare the upper with the  
lower parts of the Pelvis. It is plain to you,  
that the depth behind is much greater than  
it is before; Smellie alleges that the depth  
behind is about 6 inches & in fact it is nearly  
so, supposing the foetus turned back. We next  
take the depth of the side, and this will be  
about 1 1/2 inches. The Doctor also says that the  
depth before is 2 inches, but it is even less  
than that: so the proportions are exactly  
remembered being as 1, 2, 3. When we  
invert the Pelvis, & compare the opening  
below, to that above, there is more resemblance  
in the shape than you would at first think,  
Suppose the foetus turned back, both  
openings are oval. Smellie would persuade  
us that they are nearly equal, but the Pelvis  
is wider than it is below, even after the  
full



907. full extension is made, & they come near to  
the same size, tho' not so exactly as the Mincks.  
He compares the upper & under side in this  
manner, The breadth of the Pelvis the neck is  
5  $\frac{1}{4}$  Inches, & the Depth 4  $\frac{1}{4}$  Inches. Now we see  
very plainly when we take a measure,  
that there is more than inch in difference,  
and the size you surely conceive to vary much  
more than Smellie imagines in different persons.  
and upon of whole his Dimensions of 4 cuppers  
part are too small, tho' I find the breadth to  
be greater than he supposes. When we  
compare these with the parts before, & distance  
between the points of the Os foreig, when it is  
push'd back, & bottom of the Os Pubis is greater  
than the breadth of the Pelvis between the  
Tubercles of the Os Ischia. Tho' tho' when we  
take a superficial view, we find the sides  
of the Pelvis seemingly perpendicular. These  
are more accurate. We find that the Long  
bones at the side stand considerably, hence  
the proportions are reversed at the top the  
breadth is greater than the Depth, at the bottom



it is narrower, but the proportions are not the same, From the Os Coccygis to the Os Pubis is about 5 inches, whereas measuring transversely the distance is but 4.

Now upon these measures Amellie explains the descent of the Child's head, and that in a very rational way. I have only, some few things to remark with regard to it, which are not pointed out fully enough. A Child in the womb has its head constantly undermost, at least as long as it is suspended in y<sup>e</sup> Waters. and unless by the force of its muscles it changes its position, that as soon as their action ceases the head falls undermost, because the body is suspended by a string tied to y<sup>e</sup> Umbilicus, and the head being the heaviest part falls lowest. The Head then is applied to y<sup>e</sup> Pelvis, & a pressure is made by the Muscles of the Abdomen, by the Diaphragm, and by the substance of the Uterus itself in Delivery, or the Child is pushed strongly downwards. From the oval shape of the Pelvis, and that the



The Depth is much less than the breadth. The head cannot well pass down with the ears to the Ysa Ilea, it may happen to do so when it is small, but generally it accommodates itself to the shape of the Pelvis. The Head of a Child resembles the basin of the Pelvis, & there is nearly a like difference between the diameters, the distance between the fore & back parts is about an inch more than it is between the temples, so it enters with the ears towards the back & belly of the Mother, but when it has descended to the lower part of the Pelvis, it comes to be stopped by the Ysa Ischia, which have a stand from above inward. The Head then must here change its situation, and it does so in this manner, The Face comes to be turned to the Sacrum, and the Vertex appears under the Pubes, so the Vertex or part where the hair seems bound from a Cord is the first part which is felt. — We see then that the shape of the Pelvis is favourable to that situation, because the distance is greater between



between the Scapula. Now how comes it that the face does not present as readily, as the Occiput? This Dr. Smellie does not sufficiently point out and this happens where a Child is dead, but perhaps more readily when alive, & for this reason, That the Head is balanced unequally upon the condyles of the Os Occipitis, so that if a Person sitting in a chair falls asleep, his head humbles forward, & weight brings it down, or suppose the Head to be balanced upon the Spine, a pressure is made at the top, which affects the broadest part only, and hence the chin of a Dead Child is pushed down upon its breast, & the head from that circumstance gets the conical shape, as the Os Occipitis is pushed downwards, acts like a wedge in dilating the lower part of the Pelvis, and when the Child is alive, by an instinct of Nature the Muscles are in action, drawing the Chin to the Breast as its being the most secure situation. Add to this That the Os occipitis is a rounded and soft substance, which more readily changes its shape



311. Shape, than the face can possibly do. Hence  
this part presents first, while the Os Coccygis  
yields backwards, which is of real & material  
advantage. There is but one thing more  
relative to the Pelvis which I think necessary  
to point out to you, That we should more  
attend to the manner in which the pieces  
are connected together. There is one part of  
Os Sacrum that is covered with a cartilage, and  
which answers most exactly to a surface on  
the Os Ilium, & on a recent subject they are  
actually fixed together, so that after I have  
cut the Capsular ligament I can't draw the  
Os Innominatum from the Sacrum, without  
using considerable force. You will observe  
carefully the extent of this surface, & the  
general shape, You see it is not well fitted  
for motion, the parts being very unequal  
so that we cannot well suppose the one bone  
to slide upon the other. Next remark the  
size of the surface, there is something altogether  
singular in the connection of this part,  
much more of the Sacrum is included  
within



P. 22.

within the Capsular Ligament than is applied  
to the Os innominatum. There is a space between  
and it is filled with a substance is quite singular,  
a red fibrous matter, & there is nothing like it  
in the body, but the two bones tho' within  
the Ligament, never touch each other. I  
next take the other Os innominatum & join it as  
well as I can, in order to show the space  
left for the Ligaments - Each Ligament soft  
& the bones are very rough for the former  
adhesion, Now as I cannot draw a  
Conclusion from the structure, but must  
refer to the After examination of the  
subject, But you judge there can be no  
great degree of motion here without disart,  
or such a separation as would be very  
sensibly felt after delivery & would give  
great uneasyness. So we are not with  
some Accoucheurs to imagine that these  
Bones separate to any cons<sup>iderable</sup> distance  
from each other, but I am rather to  
follow in this Dr. Amellie, & I believe  
also



also Dr. Young, who thinks that of motion  
 is quite inconsiderable and that when we  
 suppose a free motion we ought to treat it  
 as a Disease, There is no doubt of a some-  
 - what of a relaxation from the pressure of  
 the uterus upon the returning veins. There  
 is too an irritation occasioned by the delivery  
 which causes a flow of liquor to the part,  
 and lastly, there is the Mechanical force  
 of the head acting like a wedge against  
 these joints. — When I was at Berlin, I  
 saw the Pelvis of a Woman, whose the  
 Ipsa Pubis could be made to play on  
 each other. But we are to consider this as  
 merely a Disease, & whenever it occurs we  
 ought to deliver the Woman in a horizontal  
 posture, & she should afterwards lie just  
 upon the use of the Cold Bath.

Sept. 19<sup>th</sup>

To complete the Description of the Month,  
 It remains that we should examine  
 the Ribs, which with the Muscles and



The connecting Cartilages join the Dorsal  
 Vertebrae in forming the Thorax. I believe  
 you will find it more distinct than we  
 first know the structure of the  
 Sternum, which generally in the adult  
 consists of three pieces. The uppermost piece  
 in all is pretty regular in its shape, and  
 resembles a good deal the figure that is  
 painted to represent a head upon Cards.  
 broad above & narrow below, The shape of  
 the Middle piece varies extremely, but in  
 general the lower part is broader than the upper.  
 The undermost piece called from its consistence  
 in the young subject, & its shape, Cartilago  
Ensaformis or Micromata, not only varies in  
 its shape, but we find it of various lengths.  
 It is generally somewhat more than an inch  
 but in some subjects I have seen it descend  
 a great way down the belly, two or three  
 inches. & in this case it is soft & cartilaginous.  
 In some subjects it is very much turned  
 forward, & completely grafted with the  
 piece



piece above, and this is sometimes effect of  
 disease, as when swellings are present in ye  
 belly, & at many occasions shew some symptoms.  
 The ossification of this part begins in a very  
 irregular manner, in from 8 or 9 to a dozen  
 & 1/2 portions. Now it is of use to observe this  
 because without knowing the original  
 structure, & the spaces which sometimes  
 remain long, a Surgeon might mistake  
 them for Abscesses. We next examine the  
 Os. You will attend to their head,  
 in the ends of which there are two hollows,  
 and a middle ridge, where it is joined to  
 two Vertebrae & to the Cartilage between them,  
 to their Pubicle, by which they are joined  
 to the Transverse Processes of the Dorsal  
 Vertebrae; both here, & at their head they  
 are not only covered with Cartilage, for their  
 play, but they have a Capsular Ligament,  
 at the 1st Vertebra the Transverse Process of  
 the undernmost of the two Vertebrae, to which  
 the head is connected, it remains in



a slanting direction, & does not stand at  
 right angles with the spine. You attend  
 to the furrow at the under side of the rib,  
 for Godfrey the Intercostal Blood vessels and  
 Nerves, The Diaphragm is pushed upon either  
 side into the middle of the Thorax, like the  
 Crown of a hat, as the 11<sup>th</sup> Rib, & hangs down  
 down between the ribs and this pushing  
 so that if a Person receives a wound by  
 a sword passing across the Thorax any where  
 under the 11<sup>th</sup> Rib, The Instrument first  
 passes into the Thorax, then wounds the  
 Diaphragm, & passes into the Abdomen, then  
 on the opposite side passes again into  
 the Thorax, so may wound the Bowels  
 in both Cavities. You know the general  
 elasticity of the Cartilages, these placed  
 between the ribs & sternum, not only teach  
 when bent directly but when we  
 attempt to twist them. In the end of  
 the rib which is joined to the Cartilage.  
 We find a pit which is smooth, & which  
 leads



looks us, contrary to the general opinion of Authors,  
 to consider these two substances as essentially  
 different, may, at each end of the Cartilage  
 there is somewhat of the appearance of a  
 Joint, so that you may possibly some time  
 or other meet with the Location of the Rib  
 from the Cartilage, or of the Cartilage from the  
 Mammum. Next, you will attend to the situation  
 of these Cartilages, & their Direction. Their  
 length is not only continually increasing,  
 which is a necessary consequence of the increasing  
 of the Obliquity of the ribs, but the Angle  
 they form is necessarily changing at the  
 same time, and the Cartilage does not  
 run in a straight line from the end of  
 the rib to the Mammum, but is Crooked.  
 Next, you will observe, That the lower ribs  
 stand much more than the upper,  
 being all equally connected to the Dorsal  
 Vertebrae, by their heads & Tubercles, and  
 these continually increasing in thickness  
 as they descend. In order to understand  
 the



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The motion of the Thorax, You must attend to  
The connexion of the Diaphragm, & situation  
of the Intercostal Muscles. —

Lect. 20<sup>th</sup>

We shall now consider the reason, and effect  
of the Structure You have seen. We have  
seen the head of the Rib joined to a indurated  
substance, and to the edges of the Vertebrae, and  
from this connection We derive many advantages.  
1<sup>st</sup> When a blow is given to the Thorax, the  
Shock is softened by the yielding Basis; And  
the Rib, plays on the Cartilage with greater  
ease; and with less attrition, The Motion is  
more smooth & equal, which was necessary  
considering the Continuity of its. Next a certain  
Degree of obliquity is required in all the  
Movable Ribs, the uppermost is always  
fixed, and stands out perpendicular from the  
first of the Dorsal Vertebrae. but the others  
come off obliquely. Now if the head of the  
Rib had stuck on the body of the Vertebra,  
In what manner would it have been  
connected



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connected to the Transverse process, If it had  
been joined to the Transverse process of the same  
Vertebra it would have stood at a right Angle,  
If to the one below, the slant would have  
been equal to the whole Area of a Vertebra.  
Whereas at present the Slant is only equal  
to half that Area &c. Now there is a further  
advantage which is greatly overlooked Viz.  
That by fixing the head of the rib to the  
very Centre of the motion of the Vertebra,  
these playing on their Cartilage, the rib is  
less carried along with the Spine, than it  
otherwise would have been, and tho' we  
Perceive with Difficulty in the hinder  
Parture, yet this Difficulty is less than if  
the Connection had been immediately with  
the Bones. The Connection of Rib to the  
Transverse process, not only secures it better in  
its place, but serves to regulate the motion  
of the rib, to allow it to possess that Degree  
of motion which alone is necessary for  
the purpose. The rib after we pass 9° Angle  
becomes



becomes flatter & considerably broader, Nature  
 preparing a tolerably deep seat by a broad  
 surface, & preparing it to a greater surface  
 in a particular place, by turning y<sup>e</sup> edge  
 inwards, or We find no more room between  
 them than is necessary for allowing their  
 motion. From the External figure of the  
 body We are apt to suppose, that the Thorax  
 is wider above than below, owing to the  
 projection of the bones which support y<sup>e</sup>  
 Superior extremities, but it begins small  
 & gradually widens as You go downwards,  
 the Obliquity of the ribs increasing at the  
 same time, so that their motion is very  
 evident from below upwards. In y<sup>e</sup> upper-  
 -most the motion is best observable, & all y<sup>e</sup>  
 others are pulled towards it, so suppose  
 the first rib altogether fixed, the Muscles  
 between it & y<sup>e</sup> second towards it, & thus  
 a rule That where a Muscle passes  
 between two bones, w<sup>h</sup> are both moveable,  
 the



The most moveable bone only fields, and the motion is not divided between the two bones. We find then that the second rib ascends a certain way to the Thirst, and it naturally drags the 3<sup>d</sup> along with it, when its own muscles act, so that the motion between the 2<sup>d</sup> & 3<sup>d</sup> is greater than that between the 1<sup>st</sup> & 2<sup>d</sup>, and hence all of ribs gradually increase in the degree of obliquity in order to allow of this larger motion.

Next, you will attend to the situation of the flat sides, & one good Officer will explain this, that the flat sides of all the ribs from above to the lowermost of them is directed towards the hinges, that may slide and play w<sup>th</sup> greater ease.

With regard to the Sternum, it is entirely supported by moveable substances, upon cartilages, so as the ribs are altered they carry this bone along with them. If the Superior Ethernally is kept fixed, by its own weight, or the action of the Muscles, the ends of the clavicles are the center of motion, and so



to allow it to yield we have found two  
 different Points one at either end of the long  
 intermediate piece &

We must attend to the situation of the  
 Cartilages, & to their length, the length of them  
 gradually increases, as the obliquity of the ribs  
 encreases, their ends come to be further removed  
 from the Sternum. I observed that every  
 one of the Cartilages is curved, so that we  
 cannot raise the ribs upwards without  
 increasing the reaction of the Cartilage.

From what has been observed, we may form  
 some general idea of the motion which the  
 parts of the Thorax possess in our Respiration.

Every solid Body known may be increased  
 in three Dimensions or Diameters in three  
 manners. The Thorax may be made longer  
 from the top to the bottom, & broader.

From one side to another, the ribs may be  
 drawn out, or it may be made deeper the  
 distance from the Sternum to the Spine  
 may be increased.

Now



Now You will find, That we generally and  
 Naturally increase the Thorax in all these  
 Dimensions. For first, The partition which  
 I mention'd, & Diaphragm, is a fleshy, Muscular  
 organ, cover'd above & below by the Muscles  
 proper to the Thorax & Abdomen, We see  
 it concave towards the Abdomen, and  
 convex towards the Thorax, and its whole  
 circumference is join'd to Bones which  
 difficultly yield, & the chief effect of the  
 fibres of the Diaphragm, is to bring its  
 convex surface lower down, & thereby to  
 enlarge the cavity of the Thorax, and whereby  
 it is lengthen'd out between the upper and  
 lower end. — With regard to the other  
 Dimensions, it is evident that these must  
 depend upon the motion of the ribs, which  
 We can trace from their slanting direction  
 w<sup>th</sup> respect to the spine, to near a right  
 angle, when they are push'd outwards,  
 & the distance increased between the spine  
 and Sternum. —

Am



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In doing this you strengthen y<sup>e</sup> Cartilages  
between y<sup>e</sup> ribs & Sternum, and these endeavor  
= coming to reach, independent of y<sup>e</sup> contraction  
of the ribs, directing their motion by their  
elasticity they must draw them further out  
from the middle & increase the Diameter  
of the Thorax from side to side, so that it is  
enlarged in all dimensions.

As to the particular manner in which the  
Muscles perform this office, it would be improper  
to enter on this action here, but it is evident  
that the Muscular fibres thrown between y<sup>e</sup>  
ribs, conspire in one gen<sup>l</sup> motion of pulling  
the ribs upwards. 'Tis as improbable to imagine  
with Boerhaave, that the true ribs perform  
a motion upwards, whilst the false are drawn  
in a contrary direction.

Now, tho' we for ordinary enlarg<sup>g</sup> of Thorax  
in these three ways, yet life can be continued  
by a partial enlargement. From accident, &  
in sev<sup>l</sup> diseases, we find that the play of  
the Diaphragm comes to be very much less,  
even



225. even in pregnancy the motion of the Diaphragm  
is less free, still more in a Dropsey, and if pain  
is joined to the Distension we can use it  
still less. We can still better continue life  
by the action of the Diaphragm without the  
action of the ribs, so if the ribs happen to be  
broken, independent of the bandages applied, on  
account of the pain, we cease from acting with  
them, may they have been found to press  
not only insupportably to the spine, but to the  
Stomach. I shew you a very curious case of  
this kind, in which almost all the bones of  
the body have grown together. Now it will  
readily occur to you, that as soon as the  
motions I have described cease, the stability  
of the parts, & the common situation of the body  
make the ribs return to their common place.  
With regard to the Diaphragm, more of a  
diving power is necessary. It pushes out  
the abdomen, & puts the muscles on of stretch,  
& rise & fall, while the Diaphragm is  
as it were in a Paralytic state, a very  
small force serves to return it, which is  
chiefly



Simply Done by the Muscles which contain  
the bowels of the Abdomen; and with respect  
to the ribs, the moment the Muscles cease  
from action, the elasticity of the Cartilages is  
alone sufficient for replacing the ribs, so  
that every dead body is in a state of expiration.

Now before We altogether dismiss the subject,  
We will make one or two remarks upon the  
accidents, or Diseases to which these parts  
are liable. A Wen or Direction of the Cartilages  
Encephalitis, is mentioned by Authors, as a very  
troublesome & dangerous Symptom, but I  
suspect that the cause of these Symptoms has  
been mistaken, for I find no proof that in  
its natural state, it can influence the state  
of the bowels, to any considerable degree. In  
some few cases, indeed, the Distension, within  
it is considerable, the point may be turned out  
so as to occasion uneasiness, and may expose  
the person more to injury. So in the Dropsy  
I have seen the point so much projected  
outward, that the Patient could not bear  
the



927. The weight of the Colts, and in y<sup>e</sup> Medical  
opinion We have an instance of an Ulcer so  
taking place, but that the turning of this  
part inwards, or its greater length, should  
occasion Abscesses &c. I very much doubt.  
Where this was occasioned by a blow given,  
the blow had probably affected the bowels.  
and the same symptoms would have taken  
place, altogether independent of, & farther  
back.  
If a fracture of the Sternum happens, which  
is seldom done, being supported in so many  
diff. places, upon a yielding basis, & defended  
by Ligaments & Membranes. But the  
violence necessary to break the bones, must injure  
the contained parts, and if the fracture is complete  
the parts may pass over each other, when it  
will be difficult to raise them. The only  
way to attempt it is, by reversing y<sup>e</sup> situation  
of the body, which was proposed in the  
Luxation of the Vertebrae, by bending the  
body backwards, & on a convex substance,  
when the Patient makes an effort with  
the Muscles which move the Sternum.  
and in Ambrose Parey We have a



a curious history of such a fracture being  
 replaced in this way —  
 Let us next suppose a fracture to happen in  
 a rib, which is a very common accident, What  
 kind of Prognosis would You form, w<sup>th</sup> regard  
 to the Cure? I apprehend You would make a  
 more unfavorable one than is proper, Or  
 We shall find that the ribs are easier heal'd  
 than at first sight consider'd their frequent  
 and constant motions, we would imagine,  
 But we are to reflect on the possibility of con-  
 =tinuing life, & that too with great ease by  
 the action of the Diaphragm, and that we  
 refrain from acting with the ribs in the  
 case of pain, add to this the Mechanical  
 support which the rib has from the Inter-  
 =costal muscles, & that the Neighbouring ribs  
 prevent the ends from passing each other,  
 while the Intercostal muscles like bandages  
 hinder it from sinking inward, or falling  
 outward; We suppose too add of Mechan<sup>l</sup>  
 restraint of a bandage, and in fact we  
 find that no bones in the body are,  
 Gen<sup>l</sup>



229. In y<sup>e</sup> speaking more easily healed, except when  
they are beaten, so as to wound y<sup>e</sup> Contained  
Facts, so the slightest bandage will easily  
speaking be suff<sup>ic</sup> for the purpose. Hippocrates  
recommends the falling of the Abdominal  
Viscera, May some have proposed to tie  
Belts round the Abdomen, in order to push  
the Rib outward but by throwing in a  
quantity of food, we increase the Inflamm<sup>n</sup>  
which accompanies the fracture, and  
the purpose is altogether unnecessary, since  
the Intercostal muscles are sufficient to  
support them.

When a Surgeon is about to make an  
incision into the Thorax, it is evident that  
he ought to avoid the furrow, at the lower  
edge of the Rib, and that the incision sh<sup>d</sup>  
be made at the upper edge, as high & exact  
height, or the distance from the Diaphragm,  
that can only be well determined when  
we have seen the Structure in the  
Recent subject. ~

Let.



Lect. 21<sup>th</sup>

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We now proceed to examine the structure of the  
Extremities, for the two next bones we meet  
with the Clavicle & Scapula, tho' they seem to  
be common to the trunk, & the upper extremity,  
from their situation completing the shape of the  
chest yet when we attend to their use we  
find that they properly belong to the extremities.  
So in most Quadrupeds the Clavicles are wanting;  
and in the Philosoph. Transactions we have a  
curious case by Mr. Shoelden, where the Scapula  
was torn away from the body with the arm,  
& yet the Person was able to perform motions  
necessary for the continuation of life. The  
name of Clavicle, Clavis, or key, is borrow'd  
from the Greek, but it is better named from  
its situation Collar Bone, the reason of  
Clavicle not being so easily understood, it  
is called Jugulum by Celcius; its use is  
to thrust the shoulders at a distance from  
the trunk, to alter the direction of the extremity,  
and to give it a free motion. It is not so  
much



much calculated for sustaining the humerus as  
 in the shoulder, but it is fitted for an organ  
 of apprehension. and it serves as an axis on  
 which the clavicle & whole extremity rolls and  
 describes their several motions, whilst the scapula  
 chiefly serves for a socket, for the arm. There  
 is a plate of moveable cartilage interposed, between  
 the end of the humerus & scapula, or instead of  
 one, there are two cavities in this joint, or the  
 capsular ligament is divided by a partition  
 in the middle. And this structure here as in  
 the lower jaw, serves for motion, where the  
 motion is made by strong muscles. The larger  
 vessels & nerves which go to the superior  
 extremity, pass between the clavicle and 1<sup>st</sup>  
 Rib, so that we can stop the flow of blood by  
 compression here. Therefore a Surgeon that  
 to perform an operation higher in the arm,  
 and there is not room to apply a Tormentum  
 to the top of the humerus, by making a  
 pressure on the vessels against the first rib,  
 the hemorrhage may be stopped.

The



The Clavicle is not only intended for a motion upwards & downwards, but it possesses rotation.

The Scapula is joined to it in two places, so is not calculated for great motion backwards & forwards, its chief motion being rather rotatory. It can be made to roll on its end of y<sup>e</sup> Clavicle, and from thence a very small degree of flexion & extension at the top of the humerus comes to be very observable at the top of the shoulder.

From the strong ligaments which tie y<sup>e</sup> Clavicle at both ends, we wd suppose luxation happens here rarely, & indeed they are still more rare, than from that consideration we would imagine, because when such violence is applied to the bone as ought to tear the ligament, the Clavicle generally breaks and fracture is here more frequent, than luxation. We find examples however, where y<sup>e</sup> Clavicle has started from the humerus, and when the end of it goes forwards upon the breast-bone, we can easily replace it, neither is this situation very dangerous, but when the end slips within the humerus, there is more danger, & we can only apply force to



to the further end to bring it back to its place.

The fractures of this bone, are perhaps more frequent, than of any in the body, for it not only gives way when a blow is applied to the middle, but may be broke from the Person falling sideways upon the shoulder, and as there is a greater quantity of Osseous matter near to the Sternum, than outwards, the Fracture is generally near to the top of the shoulder, sometimes so near, that it has been taken for a luxation. But we readily make the distinction, there is in both a shortness, the shoulder falls in wanting its support, but in a Fracture when we perform the Natural motions, we occasion a separation of the bones, and we feel the piece rough & unequal, Now suppose the accident to happen, in what manner are we to manage it, and what kind of Regimen is we to make? Experience & Reflection agree that as Bandages cannot be applied round the bone, and as a number of parts possessing motion



Join with it, it must be difficult to retain the bone in its place, & to keep the ends of it from passing each other. This however may be partly owing to the want of due attention in the Surgeon, who commonly endeavours only to bring the bones straight, by drawing back the Shoulders, and in this situation the body is kept till the bandages are applied. But after that, little attention is paid to the motion of the arm; Now unless you retain the humerus in the most exact manner, it must constantly roll & change its place. So after we have replaced the bones, and applied a compress to the under edge, we pin the arm to the side, and keep it there during the cure; May the Patient should refrain altogether from using the hand, and a degree of attention is even necessary in the motions of the head.

We next attend to the shape of the Scapula, and its structure, and with it we examine the upper end of the Humerus, from the Carpal-joints state of the head &c of



of this Bone, at birth, We readily understand why Luxations happen more readily in Children than in the Adult; the Cartilage which joins the Epiphyses giving way. But before We go further in considering any of the motions performed by this Bone, or the accidents to which may be liable, it will be of use to give You some notion of the situation of the several Muscles concerned.

### Lect. 22

We have examined that part of the Humerus which is connected with the Scapula; from comparing the size of the head with the socket it is evident, that a large motion is intended here; & that in all directions we can raise it, bring it forward, or backward, and by a succession of these motions, we can describe ye Circle best as the same term the Clavicle & Scapula assist in doing this motion.

The Acromion & Coracoïd processes are not intended for the play of the ball, but serve merely for protecting the Joint & for hindring the Humerus from sliding off from its place



place upwards, what it would otherwise have most readily done: so that a Luxation in this way cannot happen without a fracture of the Acromion. And the ball is retained by the end of the ridge of  $y^{\text{th}}$  Scapula, so that it is not easily pushed backward; and this Luxation does not happen so frequently as Whistler seems to suppose. When a Luxation happens here the head of the Humerus gently slips downward, or downward and a little forward. & this situation is the most frequent, as it occurs in 9 of 10 cases. It is of use to observe the gen<sup>l</sup> marks for distinguishing this Luxation, especially as in half a dozen of cases of this kind which I have attended, the Surgeons were not aware of it.

1<sup>st</sup> As the Head of the Bone is thrown inward, the Acromion must be thrown outward; and as the head passes the Glenoid cavity, the arm must be shorter, or the distance between the top of the Shoulder, & the bottom of the Humerus is less; and in  
 gen<sup>l</sup>



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Genl. The motion of the hum will be much  
less free, and the Patient can't readily put  
the hand on the head, tho' this is by no means  
an infallible mark, as it will depend upon a  
variety of circumstances with respect to the  
state of the Ligaments, the situation of the  
bone, the state of the Muscles, and age of the  
Patient. The most certain marks still  
remain, and are the following. 1<sup>st</sup> There  
is a very great hollow to be felt under the  
acromion, when the Surgeon places himself  
behind the Patient & compares the two  
shoulders. He finds the acromion of the right as  
a round ball, & under the other a deep  
hollow. Lastl, Let him take hold of the  
Patient's forearm and bend it in order to  
gett a Lever to roll the humerus, and he  
will find the ball play under his hand,  
behind the Pectoral Muscle. So that if  
all these marks are taken together  
I do not see how we can be mistaken.  
We observe that the humerus gradually  
diminishes



diminishes in size from the top downwards  
to beyond the middle, so where it is broken,  
the fracture is generally nearer to the under  
end than the top. From the situation of  
this bone, we may make a fav. le prognosis,  
as we can wrap our bandage about it,  
and from the weight of the arm, the bone  
is retained in its place, so the cures of fractures  
here, are more compleat than in almost  
any other part of the body.

We next proceed to examine the lower  
part of the Humerus, and the two bones  
which compose the Fore arm. From  
the close application of both the bones of  
the Fore arm, to the Humerus, it is evident  
that we possess merely Flexion & Extension  
at this joint, we have no rotation or  
lateral motion. From the appearance of  
the connection it is evident that we are  
subject to Deviations of the Fore arm  
backwards, For supposing the Ligaments  
to give way, the bones have very slightly  
hold



hold of each other, the coronoid process very readily slips <sup>on</sup> the hollow of the Trochlea, and the bones are carried firmly together upon the back of the humerus, We readily distinguish this accident, By the shortness of the Member, By the direction of the forearm, being altered, and best of all By feeling behind the Humerus, the shape of the Pteranon; In order to make it evident it is necessary to disengage the bones a little either by drawing them asunder, or By moving the forearm forwards, by which the coronoid process slides on the Ulna.

On the outer side of each of the Bones of the Forearm, by feeling with the finger, We can distinguish the surface of the bone, so where a fracture happens we can often discover the Broken place. If both are broke there can be no difficulty of distinguishing the fracture. But if one only, We examine the length of the Bones



Bones, with the finger drawn along them,  
 If the Ulna is broke, we endeavour to bend  
 the arm, which has more effect upon it, and  
 observe whether there is any crackling of the  
 broken parts. If the Radius is broke, by manner  
 of distinguishing it is still more evident, When  
 taking the hand & rolling it, you can make  
 the crackling as surgeons speak. When one  
 only is broke, the length is preserved by 4' long?  
 which therefore assists the cure, but we are  
 by no means to trust to this, for notwithstanding  
 they are apt to slip off part of the Radius, so  
 it should be a rule not only to confine the  
 Fore-arm, but the motion of the whole hand.  
 as the smallest degree of rolling affects the  
 Radius considerably.

In the rolling motion which we perform  
 with the Fore-arm, the Ulna remains in  
 its place immovable, or nearly so, & for  
 this purpose the upper end of the Radius  
 is nearly a complete circle, and is hollow,  
 so made to roll on the end of 4' humerus,  
 & the side of its head plays in a hollow



241. of the Ulna, & for this purpose both are covered with cartilage, at the lower end again the radius is hollow, & the Ulna is circular, so serves as an Axis upon which the Radius turns, & both motions are regulated by very curious ligaments, which at the same time confine the bones to this rolling & prevent the separation of them.

We next enter on the structure of the hand, which consists of a number of small pieces, which I have named Metacarpals, for want of a better. From the description of the bones, we readily understand their motions. Luxations in the Wrist happen very rarely, but when they do, you must be careful of distinguishing the Luxation from a Sprain, as in both, a swelling happens frequently, & that too instantly. The Luxations of the fingers are easily known, and as easily reduced, therefore it were needless to say any thing here concerning them. —

Lett.



To finish the Description of the Skeleton, it only remains that we should examine the Inferior extremities, and these so very nearly resemble the Superior, that a Description of them can be very easily understood.

The Os Innominatum has been sufficiently enough explained already, except of Socket which comes to be considered along with the head of the Thigh bone. From the manner in which the Femur is set off from the Ball the rolling of the neck serves for the Flexion & Extension of the body of the bone, so that without its being turned much out of its socket, we perform the most necessary motions. From the want of bone in the inside of the Acetabulum, the Luxation of this bone is commonly inward & downward, and the Foramen Thyroideum is so small as to stop the head of the Thigh bone, & from its standing direction it does this the more readily. But the Bone may pass almost directly upwards, & may resemble a large  
bubo



But in the groin. The knee is turned very considerably inwards, for unless the two feet are brought close together, a person would be under a necessity in every step of performing a very large motion. We could not lift the one leg till he had thrown the weight of the body upon the other, whereas at present the slightest agitation is sufficient, and as in Woman, the Pelvis is considerably broader, than in Man, the Obliquity is greater. Women when running toss the body greatly from one side to the other. The Thigh bone is round before & hollow behind in order to lodge a great number of Muscles on the posterior part, so Anatomist's figures of the Femur, are perfectly just.

The only of the Tibia which is turned inwards & forward, & which is called the Shin bone, is only covered with the Skin and cellular membrane, hence we are able to trace the Tibia its whole length with the finger. But it is more difficult to judge of fractures



of the Tibia in this way, so we must have  
 recourse to other marks, as the yielding of  
 the leg. The crackling of the bones, or pain  
 conveys the particular nature of the accident.  
 It is of use to attend to the direction of the  
 ridge upon the Tibia, as it is by no means  
 so straight as we would conceive it. But  
 describes a figure resembling an Italian S.  
 So in setting the Bone when fractured,  
 we must attend to this, & must be  
 directed by the other leg. At the upper part of  
 the Tibia there is a knob, which serves as  
 a guide in amputation. It is just under  
 the point of the Patella and a strong lig-  
 ty is the point of the Patella to it, & there  
 are several Muscles inserted at no great distance  
 from it. So as we mean to preserve these  
 Muscles, for the sake of their action on the  
 thigh Bone, The Surgeon makes his incision  
 constantly below that knob, and if the  
 Amputation be made a hand's breadth  
 beneath the Articulation, the fully preserved



the insertion of these muscles.

When We join the Astragalus to the Calcis, and Scaphoid, and look beneath We find an opening, or the Weight of our body falls between these bones; or we want a firm support here; the place being filled up by Ligaments, so that the body rests on a yielding basis, whereby We sustain a less Shock in Walking & Jumping &c And a considerable hollow or opening is made to allow the tendons, blood vessels, and Nerves to pass into the sole. In the foot, the bones are very spongy, so when a Caries takes place here, it is very difficult to cure, for it spreads rapidly from one Bone to another.

We are now fully prepared for ending on the Examining of the Recent Subjects which I shall say before you at our next meeting, and then go on in the order I at first proposed.

Sept.



Sept. 24<sup>th</sup>

## Recent Subject.

I am much to consider the shape, size, colour, consistence, the very obvious use & connections of our several organs, purposely avoiding to trace the course of the Circulating, Absorbent, & Nervous Systems, I am not confined to a any particular order. I may either proceed a Capite ad Calcem, or begin with the most considerable parts first, And instead of separating the Demonstration of the Muscles from that of all the other parts, I shall examine them in Classes, observing at the same time the situation of the other parts with respect to them, as we don't learn the Mechanism of the Muscles of one part from knowing that of another. But they are first divided simple or Compound according to the purpose they are intended to serve.

I shall begin therefore with the Eye. I will then retain these parts long more in



in their appearance by keeping the body,  
than any of the other parts do. Then I will  
proceed to the Abdomen &c as usual.

At this meeting we shall direct our  
attention chiefly to the  
Structure of the Eye, including the  
parts in the neighbourhood. I mean then  
only at present only such a demonstration  
of the parts of this organ, as I have done of  
the bones. I am not to enter into its most  
intimate structure but merely to show  
the situation & connection of parts, for  
without the knowledge of the vessels  
and Nerves, our ideas of the Physiology  
of the Eye must be extremely defective.

The Eye is filled with solid substances,  
called Humors. The Aqueous, which seems  
to possess the properties of common Water,  
The Crystalline Lens, from its shape and  
resemblance to Crystal; and the Vitreous  
which resembles melted glass, or the yolk  
of an Egg; The Aqueous humor, or Crystalline  
Lens



lens, which are nearly equal in weight, do not exceed  $\frac{1}{2}$  v. whereas the vitreous humour is about  $\frac{1}{2}$  c. in weight, or it makes 10 parts or nearly so of the whole; The Crystalline lens is enclosed in a capsule of some thickness, which we can demonstrate, and the vitreous is also enclosed in one which is exceedingly thin, and is shown with great difficulty. The surface of the vitreous humour is covered w<sup>th</sup> a Retina, or Expansion of the Optic nerve, which is not continued so far forward as is imagined it does not reach the Crystalline lens, but ends at a certain distance from the eye. Over the Retina, we find the Choroid coat, which is dark coloured on the inside, and on the outside brown, like Raper's snuff. The inner part is not composed of vessels, but seems to be altogether inorganic, or composed of an humour separated from vessels and hardened. Having the Choroid coat, we find it connected to the side of the Crystalline lens, & therefore serving to make a partition between



between the Aqueous & Vitreous humours, and as this substance (from forming a large circumference of the middle of the eye) is contracted to be connected to the small circle which the lens makes, there is not room for a straight edge, but we find it folded like the sleeve of a shirt. They have been called Libary Processes, but from the manner of their formation it is evident that there is no space thro' which light can pass between them, accordg to Sharpey who hath said that light may pass to the bottom of the eye, without passg thro' the Crystalline lens. On the outer side of this coat we find a tough substance called the Sclerotic coat, which is join'd to the clear part of the eye. Winslow & others consider this coat & the Cornea as the same Membrane continued, but they are widely different Lin has shewn in opposition to the common opinion, that the Pia Mater with the Dura



Querc are not continued to form the choroid,  
 and Sclerotic coats, but in the last  
 of these and are merely joined to it, or that  
 the Sclerotic keeps it aside as soon as it comes  
 to the Ball of the Eye. Before we find the  
 Ball supported by the skin of the Eye lids,  
 reflected upon the Ball, so that there are  
 just a doubling of the skin. The inner  
 part grows thin & transparent, but it is of  
 the same consistence till it reaches the Ball,  
 when it passes from the upper eye lid to go  
 under, so it is called the Tunica conjunctiva  
 or Aqueous. This coat therefore forms  
 the Anterior layer of the membrane of the Cornea or  
 transparent part of the Eye. And behind this clear  
 part is a very curious curtain; The Iris which  
 serves to allow the light to pass to the Retina;  
 in the proper quantity. All these coats except  
 the Iris are joined together by the Ciliary circle,  
 which is to be considered as merely a connecting  
 Medium. Lin has also shown that the  
 Choroid Coat & the Iris are totally different  
 in their Nature.

No



We next demonstrate the Muscles of the Eye, There are four Muscles nearly of the same strength and length, which come from the bottom of the Orbit and are connected to the Membranes covering the orbit from this they turn slightly forward and end in tendons of about  $\frac{1}{4}$  inch from the clear part of the Eye; then their tendons are spread out and give a greater whiteness to the Eye, so called Ten. albuginea and the whiteness of the fore part of the eye has been thought owing to these tendons, but the Sclerotic coat is every where white, only here the whiteness is increased. They are called the Recti Muscles, being as straight as they can be, from the Nature of the place. If these Muscles act singly, the plain effect is to roll the Eye; if two act at one time, the Eye is drawn in a middle line between them, and if we act with them successively, we can trace a circle on the Wall in a most accurate manner.

Next, we find a Muscle placed standing or obliquely at the upper part of the Eye which serves to antagonize the Recti muscles.



muscles, To draw the ball forward, whereas  
 the whole Neck must pull it into ye socket  
 and to do this, The Tendon of this Muscle  
 is provided with a pulley, which is fixed to  
 the Os Frontis. at the bottom of the ball  
 there is another Oblique Muscle, wh<sup>ch</sup> draws  
 the Ball forward & Southward, & turns it  
 upward.

Next, We find Muscles for the motion of our  
 Palpebrae. Albinus calls the inner edge of ye  
 Orbitaries, The Musculus fibraris, but there  
 is no Natural division. We find in the  
 hollow of the Os Frontis, the Lacrymal gland,  
 and there is a chain of small knots like ye  
 head of a large pin connecting the gland to  
 the Eye lid and the ducts take this course  
 from the glands, But they are so very  
 small that Lin. & Waller have thought  
 that the tears have been separated by  
 the Ethmoid arteries of the Eye lid, but  
 these ducts can be filled with quick silver,  
 and they are found to terminate in the  
 Upper



Upper eye-lid at some distance from the corner of the eye. Upon the Eye-lid we also find glands that secrete a mucous matter for the defence of the eye. The Glands are taken in at the outer edge of both eye-lids by 4 *Puncta Lachrymalia*, and between these you see the *Caruncula Lachrymalis*, and within it there is a doubling of the skin, which in *Quadrupeds* is called *Membrana nictitans*. *Lindes* supposes that this is wanting in the human body, and so separates Cope from Man, But in fact we have it. It is small in us, and of a semi-lunar shape, hence by some called *Valvula Semilunaris*. The *Puncta Lachrymalia* lead to the *Lachrymal* sac, and from that a duct passes down into the Nose. I can enter a probe from the Nose into it, gently. Now the bone in which it terminates, the *Sphenosum inferum* is one of those which varies considerably in their shape. We find the *Ocular* Muscle connected with



with the Frontalis, and this last hominately  
 in a tendon, which covers the whole head,  
 till we are led to a small muscle at the  
 back part of the cranium. Now you will  
 attend to this, because mistakes have been  
 committed here, about the sensibility of the  
 parts, this substance is merely a tendon  
 has been considered as part of the Pericranium,  
 but they are only joined loosely together by  
 cellular substance. At the lower end of the  
 Aponeurosis of the Temporal Muscle I can  
 pass a probe downwards to the neck, so  
 where matter is collected in the Temples  
 under the Aponeurosis, it finds its way  
 behind the Zygoma, settles down to the cheek,  
 and forms a tumour there, this circum-  
 = stance is therefore worth attending to.

### Lect. 23<sup>th</sup>

We must demonstrate the structure of the  
 Common Segments.

You have all seen a thin insensible  
 skin



Skin, raised by a blister, that is called Ecthile,  
 or Scarf skin, when this is removed a very  
 tender part is discovered, which is cutis vera.  
 From which blood runs out if it is pruned  
 or cut. Now, You know that when cutis is  
 drawn out a little we feel a resistance &  
 upon letting it go it falls back into its place,  
 or under the skin there is a connecting  
 medium called Tela cellulosa. You know  
 too that there is fat under most parts of  
 the skin. Besides when hair is pulled we  
 feel considerable pain, so we conclude that  
 the roots of the hair are deep seated, much  
 deeper than the scarf skin. You will  
 observe too that there are small pores in  
 certain parts of the skin, particularly in  
 those places which are exposed to the air  
 or to friction, as in the face, where we find  
 pores from which matter can be squeezed,  
 or there are glands the ducts of which  
 penetrate the skin, their mouths opening  
 on



on the surface. You may have observed too  
 that the tails are closely connected with the  
 Cuticle, so that by exposure to boiling Water  
 they come off together. Now these Pearls form  
 our common Argument, for there is no reason  
 to add will. The Authors who wrote about  
 the beginning of this Century a *Tunica propria*  
*Musculorum*, or *Panniculus carnosus* as a  
 common Argument to all the Muscles, so  
 to all the body, that we shall find it  
 nothing more than cellular substance  
 collapsed, the description being borrowed  
 from the Quadriped, as the Horse, which  
 possesses the power of wrinkling the skin  
 to drive off insects, We possess a sim. power  
 in the forehead & in the neck, but we want  
 it in the other parts of the body.

The Cuticle is every where composed of  
 two layers, an outer harder, and an inner  
 softer, the latter is much thicker in some  
 parts of the body than in others. The inner  
 is nearly uniform in its thickness. These  
 layers



layers are better distinguished in the Negroe, than in an European. The inner layer has been described by Malpighi, under the name of Rete, and from its softness he added Mucosum, but both terms are improper, particularly the name of Rete. We would rather call it Corpus mucosum, meaning by Mucosum a degree of stoney softness. It has been alledged that in the Negroe the blackness is confined to the Corpus Mucosum, Now I deny that fact altogether. It is deposited there in greater quantity, but it is likewise to be observed in the other part of the Cuticle, only the nearer we come to the surface we observe the less of it, the air perhaps extracting the black colour & discharging it. The Cutis vera of the Negroe has likewise a greater darkiness than in us, May perhaps the whole constitution is in some measure tainted with this colour.

We next observe the surface of the Cutis Vera, We find the Cuticle connected to it  
by



by a vast number of minute threads, which  
 were demonstrated by my Father in this place  
 40 years ago, yet a Late Writer has assumed  
 these as a new discovery. We observe too  
 that the ridges on the surface of the cutis vera  
 are not formed merely by the Cuticle, but that  
 the Cuticle covers these ridges of the True  
 Skin, sinking into all the hollows—  
 Now, You observe the cut edge, it is white, opaque,  
 & gradually becomes softer as You go inward,  
 and the whole is composed of a number of  
 threads matted very irregularly together, like  
 the threads in a glove. This has led Haller  
 to suppose that the cutis vera, is composed  
 of the threads of the cellular membrane con-  
 dense, and the skin growing softer as we  
 go inward, may seem to strengthen this  
 opinion, May it seems to degenerate into  
 a fatty substance which is sustained by a  
 cellular membrane— But notwithstanding  
 of all this, that supposition confounds  
 all distinctions. May Haller himself  
 describes



Describes them as being composed of different properties, I would only say, therefore that the cellular Membrane runs into the Skin and is lost in the Cutis vera.

The fat is supported by the cellular substance and when we examine its structure we shall find that it is divided in a very curious manner— We are at length brought to the cellular substance, we shall afterwards have a much better opportunity with the cellular Membrane, I would only observe that there is a free communication between all the different parts of it. We see then, the cellular substance supporting the Cutis Membrane and both connected to the Cutis vera. The cellular substance and Cutis Cells essentially differing. For when we blow in air to the cellular substance, it does not mix with the Fat, or when Water is first extravasated under the skin, the air is not discharged, it may be consumed in the course of the Disease, because Nobody,



is washed, but the fat is divided in a most  
 beautifull manner, and is shut up in very  
 small sacs.

Next, when We take a part of the Skin of  
 the head and examine the Hairs, We find  
 that these penetrate into the fatty membrane,  
 and each of them comes from a little bulb wh  
 is rooted in the fatty substance. In like  
 manner We find glands, which penetrate  
 the Skin by their ducts, so in the Skin  
 of the Axilla we see a vast cluster of glands  
 which are very different from the fat. In  
 the face the perforations of their ducts, are  
 very manifest, and in the Skin of the Nose  
 I have made them still more so, only by  
 taking off the Cuticle — You have heard  
 of People complaining of Warts coming  
 out of the Skin of their nose, and these  
 are nothing else but the sebaceous matter  
 lodging in the ducts, and the outermost  
 parts of it drying, get a black colour, whilst  
 the rest retains its Natural hue. When  
 We



361.

When We separate the tubule, We bring away  
the nails with it, and they agree very much  
in structure with it. We shall afterwards  
find a further proof of this, by finding a horny  
like substance growing out from different  
parts of the skin —

I avoid entering upon the structure of  
the Joints more fully, as also that of  
the Eye, till We come to the Vascular &  
Nervous Systems.

Sept. 26<sup>th</sup>

The Brain demonstrated

Sept. 27<sup>th</sup>

As I defer to a much later part of the  
Course any enquiry into the Nature of the  
Nervous System & its properties the Demonstr<sup>n</sup>  
We have made affords at present very little  
room for making any observations —

You have seen the Cranium covered by  
a thin Membrane, which differs in no  
essential circumstance from the Periosteum  
of the other bones, and to this the name of  
Pericranium should be given, it is  
connected



connected to the bone intimately by threads, and  
 many of these are vessels which contain red  
 blood. When the Periosteum is cut, it is very  
 when lined with the Dura Mater, which  
 like the Ethmoid membrane closely adheres  
 to the bone, and therefore we consider it, in  
 the first place as the Ethmoid Periosteum  
 of the inner table of the Skull, just as we  
 apply the term of Ethmoid Periosteum to the  
 Membrane lining the inner side of our ribs.  
 It requires a considerable force to make the  
 separation, and the surface of both the  
 Membrane & bone is every where covered  
 with a Number of red points, which evidently  
 show the closeness of the connection, and  
 the use of the membrane. May here, the  
 bones more freely communicate w<sup>th</sup> their  
 Membranes, than it can be shown to do  
 in any other part of the body. So every  
 bad consequence that attends the separation  
 of the Periosteum applies here. Not to  
 use



use great freedom with the Dura Mater. Next, if such a shock be given to the head, as to burst the vessels, from their size a considerable quantity of blood must be extravasated between the membrane and bone: which must have a dangerous effect upon the Encephalon— Upon cutting the Dura Mater We find that it is of considerable thickness, from which we are led to consider it as a cushion, interposed between the Bone and the Brain. On the inner side We find no adhesion, except where the great vessels come out, but We find a glary liquor effused; and as the Dura Mater has a number of vessels and the Tunica Arachnoidea has none that can be demonstrated, probably the secretion is chiefly from the Dura mater, so it performs a secretion which allows the brain to swell out & play upon it in the different states of compression and dilatation without injury.

Next,



Next, the vessels from the Brain are covered by the Dura Mater, the Sinuses are covered without & within by this Membrane, and from its thickness, and remarkable toughness it serves to prevent the rupture of the large trunks of the veins of the brain, and by attending to the manner of connection we see a further purpose served by it, that they are defended by it from comp<sup>re</sup>ssion: and from the thickness of the Dura mater, the veins by passing thro' that membrane to reach the sinuses, the obliquity of the passage serves as a valve, so that the blood does not readily turn back into the smaller & weaker vessels of the Brain, which would expose them to rupture & all its consequences.

Next, We find that the Dura Mater divides the Brain & Cerebellum into Hemispheres, and separates these organs by means of the Fala Cerebri, & Cerebelli.



& Tentorium Cerebello super extensorium, from  
 this contrivance one part is prevented from  
 gravitating upon another, either during  
 sleep, or in the erect posture, & the several  
 processes support each other, The Tentorium  
 draws down the Thalamus, and the Thalamus  
 supports the Tentorium, & in some of  
 these animals which are made for  
 sudden motions, we find a part of the  
 Tentorium ossified, or the bone projecting  
 to lodge the Cerebellum in safety.  
 Next, we find the Dura Mater covering  
 the Medulla Spinalis as it does the  
 Brain, & covering the several Nerves as  
 they go out from the bones, it gives  
 a necessary defence as in the optic  
 nerve. Next, examining the surface  
 of the Brain we find covering it two  
 membranes. The outer is without vessels  
 and it is connected to the inner by a  
 cellular



Cellular substance. The cells are very minute & slender, and from the thinness of this coat, and from its resemblance to a Spiders web, it is named the Tunica Arachnoidea. We see evident purposes which it serves. It prevents too great an evaporation from the numerous Vessels of the Pia Mater, and We may consider it as serving the same purpose which the Cuticle does to our Skin, as a defence, by it the Brain is less injured in moving upon the Dura Mater, and it ties together the Convolutions of the Brain, and is extended uniformly over the surface, so its extent is not greater than the Apparent extent of the Brain. But the Pia Mater enters double into every one of the furrows; the Surface of the Brain, & of this Membrane is vastly greater than at first sight You wd imagine. Truly it allows 4 Vessels  
to



to divide into very minute parts before they enter the substance of the Brain. When I endeavour to detach the Pia Mater from the Brain, I find a resistance from a vast number of minute vessels, as the surface of the Cortex is every where covered with red points.

We next find upon cutting into the substance of the Brain, that the Cortical Generitious as it is intimately connected with the whole or Medullary part, and that the thickness of the Cortex is by no means so great as it would at first sight appear to be. We are deceived by the convolutions, but it is scarcely equal to the  $\frac{1}{6}$  part of an inch. The connection with the Medullary part is every where very intimate, but in the Cortical substance the Eye discovers no fibres laid in a regular manner, parallel to each other, which is quite evident in the Medullary part. So there is a difference in colour and in fibres, but we find



find an intimate union, and We cannot show generous, without finding Medullary matter produced from it, or Medullary substance without offering shadowing to the Cord at its beginning. Tracing the Medullary substance We find that at length that a certain part of it terminates in the Nerves, or beyond all doubt the Nerves are the continuation of the Medullary substance of the Brain, and they carry with them the Membranes that invest it. But with regard to the origin of part<sup>l</sup> Nerves, We can only point out the place at which they seem to begin; May, perhaps the very last nerves from the Spinal Marrow, may have their first beginning in the anterior lobe of the Brain. Authors almost universally consider the Brain, & Cerebellum as employed in forming the Nerves; but there are many fibres of the Brain, which are by no means directed towards the origin of the Nerves, and the Bulk of the Medullary substance within



within any of the Lobes forms a Column; which is vastly larger than the Column made by the *Medulla Spinalis*, with all the Nerves of the head joined to it. But as persons formerly mean to point out this as a fact.

The last thing I would remark upon, is the Cavities or interstices of parts that we find in the Brain. We see no adhesions except by large veins between the *Dura Mater* & an *Inner membrane*, whether of *the Brain*, *Cerebellum*, or *Spinal Marrow*, so if a Dropsy forms between the *Dura mater* and surface of the *Brain*, it may pass into the *Spinal Marrow*, or if it is first there & then upwards and affect the *Brain*. So Water seated here may be the cause of the *Spinal Puff*, tho' as I observed before this seems very often to be a Local Disease. Where Water is collected in the head, we might expect to find it often here, yet such Dropsies are extremely rare; I have opened about 20 Cases



Cases of this kind, I mean Hydrocephalus, &  
 in every one of them, the Water was within  
 the Ventricle. Now in such cases the Water  
 is evidently within the whole Brain and  
 likewise the Cerebellum, as shew'd. fails to  
 pass from the one Ventricle to the other. For  
 under the anterior part of the Fornix, the  
 Lateral Ventricles communicate and from  
 this communication We find a passage  
 leading down into the 3<sup>d</sup> and from this  
 the passage is universally known to go  
 to the Ventricle and Spinal Marrow.  
 The passages between the Lat<sup>l</sup> Ventricles  
 may be affected by Inflam<sup>n</sup> and the  
 surface may grow together, when the  
 Water may be confin'd to one part of the  
 Brain, but I don't suppose this happens  
 so often as is alledg'd, for on opening  
 the head the Water is discharged from  
 the one Ventricle to the other in conse-  
 -quence of the Communication. All the



The same time I don't deny it is <sup>probably</sup> of the case, but in gen<sup>l</sup> the water is contained in all the Cavities of the Brain, and they all make one gen<sup>l</sup> or common Cavity. We do not well understand the use of these Cavities, we see a certain distinction of parts, but Observation does not point out it's Nature and Use of each. Perhaps they prevent the adhesion of the several Tubercles, but there may be something more. Now from the seat of the Water it is evident that we are never to imitate an Operation by some ingenious Surgeons viz. Trepanning the Brain with the Trepan, to let out y<sup>e</sup> Water in Hydrocephalus. If the Water is between the Dura Mater and the Surface of the Brain there is some little chance of relief, and no great degree of immediate Danger; but if it is within the Ventricles, the first step is to plunge the Instrument thro' the Cortical & Medullary substance, or if we



We do it in the middle, we must wound  
 the forper Callosum: which we perceive  
 fatal probably of itself & the water pushing  
 out the parts would collapse & be sore.  
 In several cases of Hydrocephalus I have  
 found the Sphum Lucidum sore by the  
 weight of the water in the other Ventricle,  
 not passing readily thro' the hole, when I  
 had cut into the first Ventricle. We now  
 come to examine

### The containing parts of y<sup>e</sup> Abdomen.

We find in all 4 pair of constant muscles  
 in the Abdomen, named from the direction  
 of their fibres, and one pair named from  
 their shape Pyramidales which are usually  
 in 1 pair of 20 or 30. The underbandous  
 part of the Vaginae extends downwards  
 passes over from the Anterior Spine  
 Process of the Ilium to the Os Pubis and  
 has been called the Ligament of Hallerius  
 or Papezotti. and thro' this is the  
 Cord.



chord in Man passes, it perforates the tendon, the fibres of which disengage one another so as to form a round hole, it is somewhat of an oval shape, but with <sup>one</sup> end of it terminating sharp, and it is filled with cellular substance and with tendinous fibres, some of which pass from the tendon along with the spermatic chord, giving a firmer sheath to it in this place. From this part there is also a number of tendons so connected down upon the thigh, to defend its muscles. In some few subjects I think I have seen a few fibres of the Internal oblique passing behind the spermatic chord, but in 19 cases of 20 the description of Albinus is just. That the spermatic chord goes below the Internal oblique, and does not perforate it as Dr. Douglass represents that there is nothing from the Internal Oblique, but that it is confined to the External.

It is necessary that you should attend to the manner in which the Rectus is situated



situated, or to the manner in which the Sci-  
 tendons get to the Linea Alba. Albinus is  
 the first Author who has given any tolerable  
 idea of that. When you look behind the  
 Rectus Pectus, at the lower part you find  
 only cellular substance with fat and within  
 that the Membrane called Peritoneum, and  
 this is the case for some way down to the  
 Os Pubis. What then is become of Sci-  
 tendons of the Transverse & Two Oblique Muscles?  
 They are all joined together, and crossed over  
 the Rectus Muscle to the Linea Alba,  
 and are there connected to the Sci-  
 tendons of the other side; hence the opposite Muscles  
 may be considered as Dyastric. but above  
 this place I find not only Sci-  
 tendons before the Rectus, but I observe likewise Sci-  
 tendons closely  
 adhering to the Peritoneum. Now how  
 do we explain this? It is plainly this,  
 Half of the Sci-  
 tendons formed by the Two Oblique &  
 Transverse Muscles pass before the Rectus,  
 and the other half behind.

Chab



That is, the whole of the Tendon of the External Oblique and half of the Tendon of the Internal course and conceal the Pectus; Again, lifting up the Pectus We see the other half of the Tendon of the Internal oblique; and the whole of that of the Transverse; And we can't only understand how the rectus is taken in, but can give a reason for it. For as the Bladder of Urine is situated here, the part above it needs to be loose, and so have free play; so the Pectondecum is only connected to the Pectus Muscles by means of a loose Cellular Membrane. But higher up a greater firmness is given to the Pectondecum to defend us against Ruptures - And this circumstance of the Ward of Tendon at the lower part is one reason why we are exposed here to Hernia; the Pectondecum yielding more; Now after seeing this structure of the Tendons, their joining. You understand the structure of the Tunica Alba, which



is only the meeting of the Tendons of the  
opposite sides, in the interspaces of the Recti,  
these not joining by their edges close together,  
so the fibres decussate at this place. In the  
middle of the Linea alba, the Umbilicus  
is found, which is only a hole in the tendons  
of these Muscles, which lets out the Vessels  
that connect the Child to the Mother.

Now after seeing these Muscles I apprehend  
You will easily understand the manner  
of their action; A very few things only need  
to be premised concerning Muscles in general.

The Name muscle is from the Greek word  
To contract as they possess the power of  
shortening. To enable them to slide and move  
freely on the neighbouring parts their surface  
is covered with a quantity of cell'd substance  
which when collapsed gives the appearance  
of a coat and was formerly named Tunica  
propria musculorum. But as every fibre  
slays upon another, we must find that of a  
cell'd substance is interspersed between  
etc



all the fibres of the Muscles, tho' the Intervals  
 between the fibres are shorter than between ge-  
 nerall bellies of the Muscles, but still they are  
 to be observed. When we follow any Muscle  
 to its attachment, we find it end in the Tendon,  
 and the fibres of the Tendon being in the same  
 genl Direction with those of the Muscle, Anat-  
 omists have generally taken it for granted  
 that the Tendon is the flesh made harder by  
 pressure, and that even parts of our Muscles  
 degenerate into tendons by age. But it is better  
 to consider them as distinct substances, tho' the  
 Tendon is to be viewed as the Ligament  
 or supporting the Muscle to a smaller space  
 of the Bone. The giving it the same Direction  
 gives it the greater strength, the fibres not being  
 drawn asunder, they in some places  
 where a muscle needs a number of fibres,  
 and is covered with a tendinous membrane,  
 if it can lay hold of Mights of Bones, the fibres  
 do alter their Direction from that of the Muscular  
 fibres,



*Fibres.* The Arguments in favour of their being  
 one substance, have still life force, they not only  
 differ in colour, hardness &c but the Muscle  
 is highly sensible, while the tendon possesses  
 very little sensibility. At any rate the  
 tendon has no power of contraction, and is to  
 be considered merely as a Cord between the  
 Muscle and the Bone. The fibres of a tendon  
 are more closely connected, so that a part of a  
 Muscle be torn, broke, or cut, it preserves its  
 gen<sup>l</sup> powers, the remaining part of a Muscle  
 acting upon every part of a tendon w<sup>th</sup> life force.

When a Muscle is thrown into action, like  
 any other stretched Cord it endeavours to  
 bring itself to the straight line. But they  
 are not always shortened when in action,  
 on the contrary they may be elongated by a  
 superior force. Thus when I let down one  
 of these skeletons, I act with the Biceps muscle  
 of the arm, at the same time I allow the  
 arm to lengthen. And we move in that  
 power in the most gradual manner, tho'



Not necessarily instantaneously.eldom moving  
Two bones, or two parts at the same time, as  
soon as the last resistance yields, the power  
is no longer directed into the Muscle.

The strength of a Muscle, like that of a rope  
must depend upon the number of its fibres  
while the extent of its action must depend  
on the length. With regard to the extent  
of their action Physiologists mistake, reasoning  
from the manner in which the Muscular  
fibres can be influenced to act. They have  
considered a Muscle as full of nails, and  
concluded that like a bladder when drawn  
out, it never can shorten itself more than 1/3.  
Now in fact few Muscles shorten themselves  
so much, but in several parts they do shorten  
themselves more. In fact they are of a red  
colour, but not always, and those that  
have the reddest colour have the greatest  
power of contraction.

Now after knowing this much of the action  
of muscles, in general I suppose that the action  
of



of the Abdomen Muscles may be explained in a few words. Beginning with the most simple the Rectus. When the Belly is convex as it is in most People, and it acts by endeavouring to bring itself to a straight line which produces it, then it acts on the ribs, if these had been secured as in Inspiration, and we shorten the Inspiratory organs, it draws the ribs down, or it is a muscle of Expiration. But if not content with this gentle action, we shorten it still more, it moves the whole Thorax forwards and bends the body; or if I am to push a substance before me, I act with the Recti muscles, draw the Thorax forwards and bend the body. But suppose a Person takes hold of a Bar, and acts strongly with these Muscles, the Thorax cannot yield, therefore of course the Pelvis will be drawn upwards and the heels may be thrown over the head, or we can throw up the feet to a



a beam above us.

In a similar way We explain y<sup>e</sup> action of the Oblique muscles, making allowance for the obliquity of their fibres. The External Oblique draws down the ribs in a straight direction, pulls down the body and at the same time turns it over to a side, or twists it about. The Internal oblique has a similar effect, may the external oblique of one side concurs with the internal oblique of the other in the same action, so We may consider them as one Digestive Muscle, & as a continuation of each other. So the operation is perfectly similar, only the right external acts at the same time with the left internal, & vice versa; Or We may throw all the Oblique muscles into action alone, or only a pair of them, and the obliquity of the one balancing that of the other. We bring the body straight forward, just as We do by the Recti muscles. I would only



only add That by the Oblique Muscles, We  
 can perform a greater flexion and motion  
 than by the Psoas. Take any proportion  
 of the Contractions You will, Suppose When  
 the Psoas act, The *Latissimus* *crurii* can't  
 descend towards the Os Pubis more than  $\frac{1}{3}$ ;  
 But when the Oblique muscles act, the one  
 ballancing the other, We can bring y<sup>e</sup> *Latissimus*  
*crurii* nearer to the bones of the Pelvis  
 in a greater proportion. The Transversales  
 have a more simple action, they can do  
 little in drawing the ribs down, but they  
 draw them inward, so are Muscles of  
 Expiration. serving to replace the ribs,  
 and are therefore the proper *Conspirators*,  
 or *Contrahitores* *Abdominis*. So they are  
 known around from bone to bone, and  
 a considerable part of them is tendinous,  
 as it would be unsafe to make y<sup>e</sup> bulk  
 of Muscle: the Contractions wd have been  
 too great, and must have affected in a  
 Dangerous



Dangerous manner the Carcass of <sup>the</sup> Wood  
 One effect of the Transversalis muscle is  
 to enlarge the action of the Pecti, by taking  
 them into a sheath: Without that as soon  
 as We bend the body, the Ribs wd have  
 swung loose, but by tying them down they  
 are kept on the Muscles, so when we are  
 pushing a substance before us by force  
 the Transversales are thrown into strong  
 action, tho' not directly contributing to the  
 motion of the Thorax, but only to enable  
 the others to continue their actions.

The Pyramidales being frequently wanting  
 shows that they have been properly named  
*Pectorum succenturiatis*, that their defect can  
 be supplied by the Pecti, which in this  
 case gen<sup>y</sup> have some degree of enlargement  
 at their lower part, perhaps they may  
 more accurately enable persons to empty  
 the Bladder of urine, tho' from their  
 small size their effect this way must be  
 very



very inconsiderable.

From the particular action of these muscles  
the general effect on the Spontaneous Respiration  
will be readily understood. They are not  
only to be considered as replacing of parts  
after inspiration, to which they are solle-  
-ited from their being stretched. but they  
promote the Circulation of the blood in all  
the Vessels, they push on the contents of  
the veins, whether red, Lymphatic, or  
Lacteal, the food being received into the  
lacteals is pushed on to the Thoracic  
Duct, while at the same time they  
promote the descent of the Turgid  
parts. We also employ these Muscles  
in Speaking, in Laughing &c. In expelling  
the Urine, feces, and in Delivery and  
we act powerfully with them in Coughing.  
Each of these actions you may consider  
at your leisure.

Sept 28<sup>th</sup>

The contents of the Abdomen demand.

Sept



Sect. 29<sup>th</sup>

Having examined the situation & connection of the Abdominal viscera and more part of the Alimentary Canal We now proceed to consider the Mechure &c

Sect. 30<sup>th</sup>

Let us now review the demonstrations made at the two last meetings.

I apprehend it may be unnecessary to detain you with pointing out regions into which Physicians suppose cavity of the Abdomen & Pelvis to be divided in describing the seat of diseases, or in directing to the making of External Applications &c for these as soon as mentioned will easily occur to you. The upper or forepart is called the Region of the Stomach, or Epigastric Region, and the sides lying under the Cartilages of the ribs are named the Hypochoondriac Regions. Under these lie the liver, spleen & Pancreas, and the

root



root of the Omentum, with the Stomach & middle arch of the Colon, with a share of the Kidneys. This reaches as far down as the 7<sup>th</sup> or 8<sup>th</sup> rib. The space between these and a line drawn between the Anterior spines of the Thor. Area is called the Umbilical Region, and the Posterior part the Loins.

Under the fore part by the small intestines all the turns of the Jejunum & part of the Ileum, and at the Posterior part at the sides of the Vertebrae we find the lower part of both Kidneys. From this to the Os Pubis is called the Hypogastric Region; and the sides are called Flank; and there we find the lower part of the small intestine, the lower turn of the Colon, its Sigmoid Flexure, and I may add the Caecum Coli, which by its weight falls down into the hollow of the Ileum.

Now, most let us attend to the structure of the several parts, and 1<sup>st</sup> We begin with the



## The Peritoneum

This is a single Membrane, for Wussler & those who speak of it as Double, have been led into a mistake from finding Water between this Membrane and the Muscles as if it was contained in a Doubling of it. But this occurs in the Cellular substance of other parts, and by separating it we only find a dense Membrane connected to the neighbouring parts by a Cellular substance. From the inner side of the Peritoneum a Moisture or liquor is deposited, not by visible Pores as Wussler alleges. They are too minute to be seen, May Jussieu observed glandular organs in a sound body from which a Section could be made, so we may imagine that a number of invisible Exhalant arteries terminate on the Surface. Following the Peritoneum we observe that it not only lines the

Containing



Containing muscles, but with a very few  
 exceptions gives an Ethereal covering to all  
 the bowels - And stretched from one bowel  
 to another forms Membranes to which the  
 name of Ligament in many places is  
 given. So the Liver is supported by the  
 Peritoneum and the manner of the  
 formation of the support is perfectly evident,  
 even like manner we observe the Intestines  
 connected to the body. For the Mesentary  
 is only the doubling of the Peritoneum with  
 cellular substance in which the blood  
 vessels run. The large vessels run down  
 along the spine, and give off branches  
 which run in the Mesentary, and the  
 Membrane passing up over the Gut &  
 down upon the opposite side our intestines  
 are tied to the body. Hence by dissection  
 one layer of the Mesentary can be raised  
 from the Gut, partly in the great intestines,  
 where the Connection is loose, and fat



fat interposed, and the Intestines left bare with  
the intestines. So tho we usually say all  
the bowels are contained within y<sup>e</sup> Periton<sup>um</sup>  
yet attending to the nature of y<sup>e</sup> covering  
it is evident that they may be left on y<sup>e</sup>  
outside of it, just as surgeons head may  
be said to be on the outside side of a Double  
Night cap, for one layer of y<sup>e</sup> Periton<sup>um</sup> is  
contiguous to the bowels, and the other to  
y<sup>e</sup> Abdominal Muscles, and between them  
nothing is interposed but the humor wh<sup>ch</sup>  
is intended to prevent concretions, and to  
allow of an easy motion. To give  
some idea of the way in which all y<sup>e</sup>  
bowels are covered, We first find the  
Periton<sup>um</sup> connected the whole way  
round to Muscles by Cellular substance,  
Then we observe a Ligamentum Latum  
at the middle of the Liver, formed by y<sup>e</sup>  
Periton<sup>um</sup> which goes off to cover y<sup>e</sup> Liver.  
Then



There is the Concave part of the Liver  
 is the Ementum miners, which connects  
 the Liver to the Stomach, & the Pustodum  
 passing over the Stomach, and going down  
 at the back part of it, or the Em<sup>m</sup> miners  
 is a doubling of the Pustodum w<sup>t</sup> fold.  
 From the Stomach we see hanging down  
 the Great Emmentum. The Ementum Miners  
 is a double membrane which opening  
 takes in the Stomach, then the two Payers  
 joining form the Anterior part of the  
 great Emmentum. In like manner & Position  
 part comes from the great intestines, for  
 the Pustodum passing over & Pancreas  
 ties it down, rising from the Spleen it  
 forms the Mesocolon, then the Mesocolon  
 opening takes in the Colon, and is produced  
 to form the under or back part of the  
 Great Emmentum. So the great omentum  
 of the Stomach & Colon are drawn asunder  
 is double, but in its natural situation  
 as



as lying over the intestines it is quadruple,  
 Dr. Waller, tho' he has bestowed some pains  
 upon this subject, yet misses this Observation  
 and considers it as a double membrane  
 but when we trace the structure it is  
 evidently quadruple. The Peritonaeum  
 is most continued, and rising from ye  
 Mesentary, then it comes back to ye spine  
 then lies over the Intestinum testis  
 and descending from the fore part it covers  
 the upper part of the bladder to which  
 it is conned by cellular substance.  
 Now it is evident that in consequence of  
 this structure the vessels can descend from  
 the great Trunks to the different Glands  
 most readily.

Now as there is no space left between  
 the Peritonaeum covering the Abdomen  
 and that part of it which lines ye bowels  
 except perhaps so much as is sufficient  
 for lodging a Tea Spoonfull or two,



of that Moisture which is intended for  
 Lubricating the parts, it is in. In that y<sup>e</sup>  
 opening of the Abdomen in a living Animal  
 is a difficult operation, and thrusting the  
 Trocar into it must be highly dangerous  
 and only safe in the case of Ascites, when  
 by the Water the containing parts are  
 thrust at a distance from y<sup>e</sup> contained,  
 the turns of the guts adhering to y<sup>e</sup> Mesent<sup>y</sup>  
 which is connected to the back bone.

Hence we make the Incision where the  
 parts yield freely, and where the several  
 turns of the bowels are accurately tied down  
 by their Membranes to the parts behind.

Next it is evident that there is a free  
 passage the whole way between y<sup>e</sup> surface  
 of the bowels & the containing parts, so we  
 distinguish Ascites by the Water falling to  
 the Undermost part, while in local Dropsies  
 the Humours heape nearly to one place.

The Color from the Nature of its Office which  
 contains the peculiar matter hardened, is



is very subject to disease, so in Morbid Dropsical bodies We find an Adhesion of y<sup>e</sup> upper arch of the Colon the whole way across y<sup>e</sup> Abd. m. and if a Dropsy succeeds the Adhesion, there may be a necessity for making two peritonies.

From one part of the structure I would make some observations which have not been attended to, with regard to the great sac to which the Peritonium of Winslow leads, behind y<sup>e</sup> Capsule of Glysson, where We find a hole bigg enough to admit a Couple of fingers. It passes throught the Stomach & Omentum Minus, between the Stomach, Mesocolon, Colon, and so into the Cavity of the great Omentum. Now as the Peritonium of Winslow is the only outlett from that cavity, and as it points to the Right side, We are not to prefer making y<sup>e</sup> puncture in the case of Abscess upon the Left side. On the contrary as a general Rule I would prefer the Right. The reason which Surgeons give for preferring the Left



Left is, That the Liver is often the cause  
 of Dropsy, becoming whinny, hence they conceive  
 that the Liver pushing far down may come  
 in the way: but I would alledge that such  
 an enlargement happens very rarely, and  
 We as frequently find the spleen in a diseased  
 state considerably enlarged, and when it  
 is diseased it is more ready to change its place,  
 than the Liver, from the looseness of its  
 connection. So in the book Wrote by My  
 Brother on the Dropsy, You have an instance  
 where in the case of an enlarged spleen, the  
 Surgeon made the puncture in the common way  
 and Wounded it, which was discovered after  
 the Patients death; May without being much  
 enlarged it sometimes changes its place. I  
 saw a Case not long ago where after delivery  
 it had fallen down some way, so that  
 the danger of puncturing the Spleen is nearly  
 as great as of wounding the Liver.  
 In general we can examine if either is in  
 our way but should We not know the  
 state



state of the bowels, the Caesarian frees us  
 from Danger, and when We make a puncture  
 on the Left side the Sac to which the Foramen  
 of Winslow Leads remains filled with Water,  
 whereas making the puncture on the Right  
 side We can empty every Drop of the Water.  
 Further the Water may be confined to that  
 particular place, from a contraction of the  
 mouth of the Foramen, in consequence of  
 some Degree of Inflamm<sup>n</sup> of the Liver being  
 in a diseased state, & proving an Obstruction  
 to the free return of the Blood, a Dropsy may  
 happen more readily here than elsewhere,  
 and in this case the Stomach & Colon with  
 the Intestines will be pushed forward & twist  
 the Water and the containing parts. So when  
 the Water is Confined to the superior part  
 of the Abdomen, in making the Perforation  
 We ought to work the Trocar like a Drill  
 rather than plunge it in suddenly at once  
 as Surgeons generally do. We next attend  
 to the Structure & Situation of the parts of the



## The Alimentary Canal.

Considering what is common to it, as we have seen one general structure, then we shall make a few general remarks where circumstances that are proper to the different orders occur. In all we have seen three, or as Anatomists commonly reckon 4 general coats in the Alimentary Canal. The 1<sup>st</sup> Coat is y<sup>e</sup> constr<sup>o</sup> of the Peritoneum, and whilst we mention the use of it, we in gen<sup>l</sup> mention the use of that membrane viz. That By its firmness it enables the canal to contain the air, and other substances taken in this is the most obvious use of it. Next, the surface of the bowels in gen<sup>l</sup> by means of the Peritoneum is rendered slippery, whereby they perform their motions one each other with ease, one part slides on another with less friction and with less danger, as the Peritoneum possesses a smaller degree of sensibility than the most coat does, and as the Peritoneum has fewer vessels, the danger of adhesion between



397. between the different parts is thereby separated,  
And this is by no means an uncommon or  
rare occurrence.

Within the Peristomum we find a Muscular  
coat, and however insignificant that may  
appear, yet the proper function of it is altogether  
to the maintaining of life. For without its action  
no external pressure can push the food thro  
the Canal. Let any one attempt to cause  
Quick silvers by the pressure of his hands, or  
even the agitation of the belly, to disengage  
burns of the Intestines, he will find it quite  
impossible, because of the length of its sides  
and the burns they make upwards as well  
as downwards. So the action of this coat  
is absolutely necessary, and the manner in  
which it performs this action is — When  
we look into Authors, the genl. mode of action  
is described under the name of Peristaltic  
and Antiperistaltic, but the greater number  
have a false notion of this action. When  
a Stimulus is applied, or a portion of food,



is taken in they suppose that there is a  
 continual action, without any interruption  
 from top to bottom, that the matter of y<sup>e</sup> food  
 is in perpetual motion. Now this motion is  
 much less observable than many seem to  
 conceive, and we shall never find that it is  
 uniform from top to bottom. But that it goes  
 on in a seemingly irregular way in diff<sup>t</sup>  
 parts of the canal. Nay from seeing gladders  
 in life, upon laying open the Abdomen, we  
 are at a loss to determine the action of the  
 food. We may compare the motion to that  
 of the sea, which when it is going out, it  
 seems to be coming in, & going out all day,  
 and we scarcely can distinguish w<sup>h</sup> motion  
 is the greatest. We observe much the same  
 of the alimentary canal of animals, wherever  
 it is stretched with food, there the motion is  
 most considerable, it goes on, stops, then the  
 motion is renewed, so the anti-peristaltic  
 motion is a natural one as well as the  
 Peristaltic one, and it serves to turn over  
 the



399. The food in all possible ways, from the  
Disposition of the fibres which are placed in  
a Longitudinal direction as well as Transverse  
and Circularly. When a portion of the Canal  
is irritated by the food, first there is a contraction  
of the Circulatory fibres immediately above  
the irritation made, for there is a general de-  
termination of nature from above downwards  
in whatever way the stimulus is applied.  
So from an injection the motion is not inverted  
because the irritating substance first touches  
the lower part, but the natural motion con-  
tinues notwithstanding. So the part to which  
the stimulus is applied contracts & makes  
a firm point, to which the other parts can  
be drawn, and the Longitudinal fibres  
are in action to shorten the canal, and  
to dilate in some measure the under part,  
and here as when we pull or shock  
upon the leg the effect is much the same,  
whether the food is pushed down into the  
gullet



Gut, or the gut pulled up upon the food, and  
 by these means the circular fibres push on  
 the contents with the greater ease, & a farther  
 way in a shorter space of time, upon the  
 whole considering the uses of the Muscular  
 coat they are various, highly important  
 and necessary. First, a general motion &  
 agitation of the food serves for the mixture of  
 the several, it depolues several parts, and  
 combines others, promotes the general Dis-  
 = charge of liquors into the cavity of y<sup>e</sup> Intest-  
 which are highly necessary to Animalize  
 the food and depolue it as a Menstruum.  
 Next, by the Muscular action the food is  
 turned over & over & presented various ways  
 to the surface of the intestine, now there is  
 a motion downwards, and a certain surface  
 touches the inner coat of the intestine, then  
 this motion is reversed and a different  
 surface presented to the food is more acci-  
 ==unably applied to the Mouths of the  
 Absorbent vessels, while by the contraction  
 the



The fourth part is carried downwards. The useful part already received into the Lacteal vessels, is pushed on towards the heart, for the food is not pushed into the lacteal vessels but is imbibed, as the pores on the surface of Vegetables imbibed their nourishment.

But the Muscular coat pressing on vessels crowded with Valves pushes the food on with considerable force, in so much that in several different experiments after tying the Thoracic Duct I found that some large branch of it had given way, and I make no doubt that the Muscular action of the Milky Canal had its part in occasioning the rupture.

Within the Muscular coat we find two others called Nervous Gullies. The name of Nervous is known by all accurate Anatomists to be improper, we only retain it for want of a better. It is difficult to trace nerves into it, the branches turning so minute before we get this length, that we in a great measure lose them, and it is difficult to show that



That Coat possesses any high degree of sensibility,  
 But not only is the name improper, but y<sup>e</sup> idea  
 of Authors with regard to the nature of these  
 two coats is still more so. If You look into  
 the most recent Writings on the Subject, You  
 will find that some think that the villous  
 coat resembles the Cuticle, & the Nervous y<sup>e</sup>  
 Cutis vera. But the villous coat resembles  
 both, and We need no other argument in  
 proof of this than the vast number of vessels,  
 and the high degree of sensibility which it  
 possesses. So I would compare y<sup>e</sup> Nervous  
 coat, to the subcutaneous cell<sup>r</sup> membrane  
 without the fat: it is like to cellular subje<sup>c</sup>  
 condensed, only the threads are finer and  
 shorter, and I have shown that by blowing  
 in air we convert it into cells, along the  
 threads of which the blood vessels & Nerves  
 are conducted to the villous coat, so, like  
 the cellular membrane to the skin it  
 gives



gives a certain degree of firmness & support to the Villous coat, keeps it in its place & conducts the vessels to it. and the Villous coat like the skin is covered with the Cuticle, which is very thin, & is scarcely to be said, but is certainly present. I think I have seen it the skin and even separated as in cases of Aphthae from the vessels. These Aphthous spots or vesicles are seen in children, are very thin & thickened into a Membrane, but in some cases by separating this matter, the more of sensible surface was exposed, or there was an excoriation. And often when there is a separation of sloughs, as in Dysentery, the skin & canal is equally sensible, just as the skin is where the Cuticle is separated from the surface of the body.

The two inner coats, the Muscular and Villous, are much longer than the others, and hence we find a number of ruptures or Wakuli constrictions, the place of which is



is more human and than some seem to  
imagine, I cannot shift the place of the  
valves without using considerable force.

We call the inner surface villous, now  
I have a strong suspicion, that the Villi  
are further subdivisions of these valves, con-  
=sisting that every valve is subdivided  
=like the parts escape the naked eye. or that  
these serve to increase the surface of the  
inner part of the alimentary canal very  
considerably, and to make a certain resis-  
=tance to the descent of the food, or to its  
coming back again in the Anti-peristaltic  
motions, further, there is by means of these  
valves a closer application made of the food,  
it is entangled by the greater doublings of  
the surface is immensely increased, for a  
greater number of Whiskers and inhaled  
Nipples, the food is more animalized &  
more readily received into the constitution.  
So that we can assign reasons for this structure.  
Thon



405. Of this structure - I mean the a general  
defence the stomach is separated into a  
canal from a number of pores, which we  
cannot show with the naked eye. They  
are most remarkable about the Pylorus,  
in the Duodenum, about the end of the  
small intestine & the middle of the  
Reckum, and where we see in these places  
we presume to take place in all.

Let us next view the particular parts  
of the alimentary canal, beginning with  
the Stomach, and first, you have  
seen that the Oesophagus goes thro the  
fleshy part of the Diaphragm. Next,  
we observed that when the Stomach is  
moderately distended, instead of being just  
the flat sides forward & backward,  
they are bent upwards & obliquely  
forward, and there is a resistance  
made to the ascent of the food by the  
turn



turn the Stomach makes with the *oesophagus* where it is joined with it. So the contents of the Stomach must not only ascend contrary to their own weight, but there is a resistance made by this turn: as also by the fleshy side of the hole of the *Diaphragm*, thro' which the *oesophagus* passes. which will be when the *Diaphragm* is in action, and the contents of the stomach are most in danger of being thrown up. Not but that the ascent of the food may have taken place when the *Diaphragm* is in action, I find I can swallow in the time of Inspiration but it is with a certain degree of difficulty.

Now, from what we have remarked that applies to the Distension of the Stomach, the Curvature is turned more forward, and the angle between the *oesophagus* and Stomach is increased, and as the Stomach performs the same general Measure

with



with the rest of the Alimentary canal, has long & delicate fibres extending from the Cardia to the Pylorus, which are just upon the Middle, so that both orifices are strengthened, it is evident that tho' a certain quantity of liquor is necessary in the time of vomiting if the stomach is greatly distended with liquor it is in danger of being burst; not that this so readily happens as one would imagine from viewing the dead body, for in life the parts support each other, when they are in the situation of a thin bladder included in a foot ball, the containing parts of the Abdomen serve a similar office.

Next, the pyloric valve in proportion to the stretching of the stomach the Pylorus ascends higher when the stomach is empty this part hangs down, but when it is distended it comes nearer to the same height with the superior orifice. That the heavy or indigested parts of the



The food, may not pass out of the stomach  
 by their weight, while in the course of  
 Digestion a quantity of air is engaged with  
 the food and renders it lighter, so that it  
 swims on the surface, and from y<sup>e</sup> situation  
 of the Pylorus, such parts of the food are  
 chiefly received into the intestines. From  
 attending to this situation we see properly  
 of the Question given by Winslow, for discharging  
 hard substances from the stomach into the  
 Intestines, i.e. first to lay the Patient on his  
 back, then to turn him to the right side.  
 Thus suppose a child to have swallowed  
 a Shilling which is a case I met with  
 some time ago, and the child had been  
 vomited to no purpose. I followed Dr  
 Winslow's Question turning the body to  
 the Right side, then to the back, After  
 I had ordered a pretty smart Purgative,  
 The Shilling did not come away that day,  
 but did the next, and I make no doubt  
 but



409. but the posture did contribute somewhat.

All the inferior orifice we find not only a sphincter, but a real muscle which makes a complete sphincter, and this acts with so much vigilance that in such animals as take in hard substances into the stomach, as birds, which take in small stones, We shall hardly ever find any of these hard bodies in the intestines; and if in the human body they pass, it is done with a degree of violence. I have seen a case where pretty large gall stones were vomited, but that orifice by the action of the muscle is a great deal smaller than it appears in a dead body.

We next find the Duodenum led very fast down to the posterior part of the Diaphragm by a cellular membrane; it appears not only longer, but makes several turns, and receives particular liquors into it,  
So



So it has been called very properly by Wich  
a Ventriculus succenturiatus. After it has  
 crept over to the left side it receives the  
 Mesentery, and is changed into Jejunum,  
 then we find this becoming very thick;  
 but we can neither say where Jejunum ends  
 or thick begins; so we might w<sup>th</sup> Physicians  
 comprehend both under the name thick.  
 The great differences are, that the upper part  
 is larger, the coats thicker, and the valves  
 more numerous; from a necessity of a  
 greater measure of the animal liquors w<sup>th</sup>  
 the crude Aliment, and the greater Absorption  
 which takes place here. At the bottom of  
 the thick we see it makes a turn to the  
 right side, & joins w<sup>th</sup> the Colon, and here  
 we find a streptomy in the dead animal,  
 and this will be necessarily increased  
 in life; because the whole of thick  
 enters at the side of the Colon, & circular  
 fibres



411.  
fibres of which being stirred by the Distension,  
must draw it together. In the Dead body  
there is a certain degree of resistance when  
air is thrown in, and from the action of  
the Muscular fibres strengthening it still more  
in life, it will be necessary when throwing in  
air or any matter by way of injection, in the  
case of Uterus, to proceed with the greatest  
caution, for if there is faeculent matter in the  
Caput Coli, the injection can't be pushed  
farther on, and those who have reasoned  
differently as Dr. Haen, have made their  
experiments on Dogs, where the connection  
here is more like that of the Duodenum  
with the Stomach. We w<sup>d</sup> consider the  
Appendix Vermiformis as an organ w<sup>ch</sup>  
secretes, or a quantity of mucus to be  
added to the faeculent matter, in a  
particular kind of case, where this appendix  
is wanting we find a Mucous fluid  
secreted



situated near the place of it, and in some  
 cases there is a considerable quantity of stone  
 found within it. We judge that the  
 size of the Caput coli, and balls sometimes  
 found here, and it may be impossible to cause  
 them pass forwards, from the opening of  
 the diameter of the jejunum. We find the  
 Colon from the second turn it makes is contin-  
 -uous to almost all the Abdominal Viscera,  
 so that when we examine these on the  
 suspicion of Schirous tumours brought  
 to attend to the state of the belly but we  
 mistake hardened feces for such tumors;  
 or be deceived by such balls as I was just  
 now mentioning. We also judge of the  
 effect of Injections upon all the Abdominal  
 Viscera, that whilst they discharge  
 the contents of the Intestines, they prove  
 a fermentation to the neighbouring viscera.  
 Lastly, it sometimes happens that various  
 are



are made and the Patient gets rid of the  
 Disease from the operation of y<sup>e</sup> Abd. Evacuor.  
 Thus I remember a Case that was treated  
 even in the Royal Infirmary by Dr. Wright  
 who bled the injections given him, in  
 8 or 10 minutes, at the same time <sup>had</sup> ~~would~~  
 taken <sup>ing</sup> to the Morbidity was not more of  
 Discharge by stool, suspending the cause,  
 I examined the Patient, & when y<sup>e</sup> large  
 arch of the Colon passed more of under  
 the Morbidity there was an adhesion  
 of parts, & a number of hard lumps, so  
 there had been an immediate erosion,  
 but as the Patient did not dye, I had not  
 an opportunity of ascertaining y<sup>e</sup> parts  
 of the case. In like manner, when y<sup>e</sup>  
 Liver suppurations its contents may be  
 Discharged into the Morbidity, & the Discharge  
 may be passed by stool, and in Dropsies  
 of



144.

of the Cranium, and where the Ossifications  
have taken place matter has been dis-  
-charged by stool; and an excreta having  
taken place fully explains this.

### Lect 31<sup>st</sup>

Having now seen the situation & Connection of  
the important Chylopoetic Viscera, the Omentum,  
Pancreas, Spleen & Liver. We are now to examine  
their structure as far as can be done by Dissec<sup>on</sup>.

### Lect. 32<sup>d</sup>

As the important Chylo-poetic Viscera perform  
their office by means of secretion from y<sup>e</sup> Blood,  
We can't pretend to explain the manner of  
that, till the course of the Vessels, and the  
intimate structure of the parts be fully  
known, when we shall at considerable  
length not only attempt to determine the  
gen<sup>l</sup> office of each, but the manner in wh<sup>ch</sup>  
that office is performed.

We observe that the Omentum even in  
the erect posture of the body only reaches  
somewhat



somewhat lower than the Umbilicus, while  
 in the Quadruped we find it extended as far  
 as the Os Pubis. Hence we see the impropriety  
 of considering it, with Authors, as intended to  
 preserve the Warmth of the Abdomen, for as  
 the Liver had needs as much defence as the  
 upper, this use must be put out of question;  
 and I would assign as its primary office, the  
 separating fat in order to allow the several  
 bowels to slide with ease upon each other,  
 and to prevent their adhesion. and We  
 readily account for the difference of extent in  
 the Human body & in the Quadruped from  
 the difference in their intended posture. And  
 an argument was needed to prove that  
 Man was not intended to be a Quadruped.  
 We may remark this, That in Man the  
 Ligamentum extends only to the Umbilicus  
 that its weight in the erect posture is  
 not sufficient to drag it to the bottom of the  
 Belly. And the Ligament falling to the  
 lower part, if it had been extended further  
 there



There must have been too great a quantity at  
the lower part. We observe that there is an exudation  
thro' the pores of the Fatty receptacles, and I'll  
apply this when speaking of the feet situated  
in other places, as under the skin.

In Morhaave & Haller we find several other  
uses assigned to the Omentum, as the support  
of the bile in the Liver, here I will only observe  
that there are numerous lymphatic glands  
situated at the root of the Omentum which may  
lead us to reject this use; and perhaps after  
all we shall find room only for admitting  
the primary use of it which I've mentioned  
as lubricating the surface of the several  
bowels. Instead of learning much from the  
appearance of the Spleen, with respect to  
its use we are left entirely in the dark;  
We observe blood vessels dividing thro' it, and  
a vast quantity of blood circulating, We also  
observe Lymphatic vessels coming out of it  
and Lymphatic glands in the concave  
part of it, but we don't observe them to be  
more



47.  
more in number here, or diff<sup>r</sup> in their colour  
from what they are in other places. And as  
we are unacquainted with the course which  
the blood takes from the spleen to the heart,  
we leave its office to be opened afterwards.  
only from the extreme softness of its texture  
we would reject the opinion, that accord<sup>g</sup>  
to the state of the stomach, being more or  
less empty, this organ swells out & contracts,  
and I would add as a fact that there is  
no kind of relation between the size of  
the stomach & that of the spleen. The stomach  
tho the quantity of food in it be small  
may be distended with wind & the parts  
of the abdomen being soft and yielding to  
the weight of the atmosphere, there is no  
need for any such ballance.

We can speak with more certainty of the  
use of the Liver, as we perceive not only  
the division of Vessels in it, but we find  
a duct coming out from its conveying bile  
into the Duodenum. So the Liver serves  
for



for the separation of the Bile, and the only  
 doubtful point there is, whether the Liver  
 separates the bile which is contained in the  
 Gall bladder; or if a separation is made from  
 its proper coat, or whether the bile in y gall-  
 bladder is essentially different in its nature from  
 that separated in the liver; and I shall attempt  
 to settle this matter w<sup>th</sup> an absolute certainty.  
 I would only observe here that the Hepatic  
 & Cystic ducts join without the interposition  
 of Valves or oblique passages, which presently  
 prevent the free motion of the bile in any  
 direction while solid bodies are stopped by  
 the Rings we find here.

We see the end of the Biliary duct joined  
 by a duct from an organ called Pancreas, wh<sup>ch</sup>  
 we shall find afterwards to resemble gland  
 near the mouth which pour out chittle, from  
 which we conclude that the fluid prepared  
 by it is entirely the same w<sup>th</sup> the Saliva.  
 Authors tell us that the Pancreatic duct  
 joins with the Ductus Communis in order  
 to



419. To divide the bile, and at the same time  
they all agree that the Bile is collected in the  
Gall bladder, that the Pancreatic ducts may be  
carried off. We would only say in general  
that the Bile & Pancreatic juice are both of  
use in Digestion, and serve the purpose best,  
when blended together, leaving the future  
experience to determine the office of each,  
or of the mixture of the two.

We proceed to consider the organs of Urine  
and Generation, at the same time amongst  
the few Muscles we find in the cavity of  
the Abdomen.

### Lect. 33

The Demonstration of the Organs of Urine  
and Generation continued.

You have now seen three principle  
passages at which Urine happens. 1<sup>st</sup>  
The passage at the Umbilicus, at the Ring  
for the Spermatic chord, and the passage  
in the Bligh. When we draw off the  
Peritonaeum from the Umbilicus, we find  
that



That this is only a round hole, The linea  
 alba in the tendons of the muscles covered  
 by the Pectendium, but the sides tied together  
 by cellular substance. and you will readily  
 understand the covering the bowels receive  
 here, and the manner in which they will  
 be situated. The hole in the tendon is round  
 and very hard, so that this species of Hernia  
 will be more rare than the others, it will  
 grow more slowly, & extend more equally,  
 so the adhesion will be more frequent.  
 Thus the Surgeon need only take care  
 to avoid wounding the bowels, He need  
 not mind the direction to cut in a certain  
 direction in order to avoid the Umbilical  
 arteries or Vein, as being of some use in  
 sustaining the Liver, but the chief danger  
 is in wounding the bowels, which we  
 must carefully avoid.

If the Bowels push out at the Ring  
 of the External oblique, being situated  
 within



424. within the body as the fore part of the  
Spermatic cord, they will very continue  
in that situation, they will push down  
into the Scrotum on the fore part of the Chord  
So this species is named Scrotal Munia, it  
has been improperly called Inguinal, but  
this title is more properly applied to the  
last of the three common species, generally  
named Crural. When you cut upwards  
and outwards the part of the tendon you  
cut is thin, & need not need, you could  
almost slit the fibres, it is better however  
to cut them somewhat across in order to  
give soon, and here there is no considerable  
part in danger.

The Crural, or Perineal Munia in  
which the bowels pursue the course of the  
Perineal Vessels behind the tendon of the  
External Oblique. In the other species  
where the moveable bowels are concerned  
they push the Rectum down before them,  
but



But the Vesica Minora wanting its covering  
 as the upper part, there is here no Coat from  
 the Peritonaeum. If we cannot reduce the  
 bowels by pushing them upwards and a  
 little inwards, we must cut the Ligament  
 of Gallipus, which with Caution may be  
 cut thro' without any risque of opening  
 either the Epipastic or Spumatic Vessels.

Now tho' these are the most common  
 species, Hemorrhage happens in a variety  
 of other places, wherever Vessels are going  
 out, as in the Thorax with the Respiratory,  
 Aorta or Vena Cava, with the large nerves  
 that come out from behind the Plevis &c.

In attending to the situation of the  
 bladder we readily determine the proper  
 place for puncturing it in the case of a  
 Retention of Urine. Mr. Sharpe advises  
 to do it above the Pectus, which is very  
 practicable, but the more common & safely  
 is to do it under the Lymphatics, and the  
 bladder.



Bladder slips away from the instrument  
and the Water gets between the Membrane  
Cellular substance. So it is better I think  
to make the Puncture at the lower part  
in order to favour the Descent of the Urine,  
and to leave a flexible Catheter without the  
Danger of the Bladder slipping away from  
it, or of hurting the neighbouring parts.

Now some have proposed to enter a  
Crooked Trocar within the Rectum, then to  
bring the point of it forward, and so  
to puncture the Bladder. But in this  
way we wound the gut unnecessarily;  
or supposing that this is attended with  
little Danger, we cannot well avoid  
the Vasa Defensiva & Vasa Seminalia,  
So a better Place will be the puncturing  
of it at the edge of the Prostate gland  
and near its Cervix, which is very practicable.  
I would enter the Trocar between the  
Bulb of the Urethra, and the Crus of the  
Penis,



penis, then thro' the very thin Levator Ani  
 and so into the Vesica Uterina, cutting the  
 skin with the Scalpel to make the oper-  
 easion, We give the instrument the direction  
 upwards, & rather keep a little inwards  
 in order to strike the bladder near its Cervix.  
 Next, I shall make such a cut as I know  
 to be most proper in Lithotomy in what  
 is called the Natural operation, To guide & e  
 incision I introduce a finger & probe, or  
 as it is call'd a Staff into the Urethra, till  
 I reach the bladder. An Assistant holds  
 this while the Surgeon makes the incision,  
 with a Common Scalpel, where I proposed  
 as the best part for the procedure. After  
 dividing the Skin & Cell. substance, he  
 next divides the Transversalis Muscle, &  
 the Levator Ani, then He makes a cut  
 in upon the Condutor a little to ye side  
 of the Prostate gland, & half hold of the  
 Condutor, he can pass a knife or any other  
 inst. into ye bladder cutt thro' the Pro. gland.

Set.



After showing the structure of the urinary and seminal organs, I shall collect some material parts of the Demonstration together in order to explain somewhat of the use.

We find the Adreny defended by a quantity of fat, & within its adipose coat we find a proper coat of the Adreny, closely adhering to it and at the fore part invaginated & joined to y<sup>e</sup> Plevis and beginning of the Uterus. This ties together the diffurant tubes, and tho' it appears in the Adult an Uniform Membrane, yet it has in a great measure been formed from the Cellular substance condensed, and We are rather to consider it in this way than as an original coat, because in the Fetus y<sup>e</sup> space between the lobes are joined loosely by Cellular ss. When we cut y<sup>e</sup> Adreny we find what is call'd cortical substance; but the name is only proper when it is applied to each of the original tubes, for these growing together, what is named cortical is very deep within the ss of the



the kidney, so that it is better to call this the  
 Vascular, summing part, where the vessels are  
 fitted for making the secretion. Within we  
 find the substance called Medullary, which  
 has been borrowed from the resemblance  
 the Brain has to the kidney, it is better named  
 Tubular Mass, for, the several tubes are  
 collected & joined into larger, and a great number  
 at length join to form any one Papilla, and  
 this papilla hangs within the pipe that  
 conveys the Urine towards the Uterus, I named  
Infundibulum. The Intention is to prevent  
 the urine from regurgitating, so this structure  
 serves the use of a valve, as the more you distend  
 the Pelvis of the kidney the more the sides  
 of the tubes are squeezed together. As the  
 number of original lobes varies in different  
 subjects, hence we find great variety in the  
 number of Papilla, and still more in the  
 number of Infundibula. Often two or more  
 Papilla are within one Infundibulum, so  
 we are not to receive the common Description  
 of



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of the way these join to form the Pelvis as  
taking place without Variation.

From the part of the Pelvis projecting behind  
the convexity of the Kidney we see under  
continued, and We see a possibility of cutting  
into its cavity without wounding the Kidney.  
But the incision must be made very deep,  
a great many muscles with the common  
teguments and a quantity of fat must be  
cut thro' and after all on account of their  
size and the shape of the Pelvis, you could  
not easily extract them. I do not say  
that in no case an Operation of this kind  
is to be done, but at least there are many  
things to discourage us from the attempt.

From the size of the Pelvis compared with that  
of the bladder, the motion of the stone must be  
slower in the former, so calculi are apt to form  
there: and from their size & want of vis a tergo  
they may not pass readily. But supposing  
them small, the bladder is unequal in size  
in different places, so they are apt to stop,  
or



or they often descend with great difficulty.

There is one contracted place at the edge of the Pelvis, from the pressure of the Psoas muscle, and another great contraction where the Uterus enters the bladder, so that stones may sometimes stop there for a long time and produce fatal symptoms. In the Male the place is scarce to be reached with the finger, but in the female there is room for an operation which I shall propose & explain. The Uterus in its whole course is a Muscular organ, it is strange that Haller and others will allow themselves to be misled by Theory & Analogy. Haller supposes that the Skin is reflected from the Glans Penis to form the Uterus, but it is composed of a Condensed Membrane on the outside, has the same membrane with the bladder on the inner side, with many ducts pouring out Mucus, tho we can't see them distinctly and there is between these a fibrous coat which



which is evidently Muscular. I have seen an evident & large action of fiber lying length on touching the bladder we see its motion like a worm, not only altering its diameter but its place. And this circumstance explains the use of Opium in Calculous cases, that by lessening the irritation we remove the constriction of the ureter, so that the urine more readily pushes out the stone.

The structure of the bladder agrees with that of the Uterus. We find the Muscular fibres disposed in Fasciculi, and the Intimal Membrane appearing between these, and this muscle is very Dilatable, accommodating itself to the distension of the bladder, and we may understand how bags are formed here by Calculi, the inner coat passing out between the Bundles of the Muscular fibres, forms a hernia, so that Surgeons may find great difficulty in catching a Calculus. When



When We trace the Course of the Muscular  
 fibres, we find them matted together; Or We  
 find fibres fitted to Contract the bladder in  
 all Directions which they do with the great-  
 -est accuracy. — And reflecting on what happens  
 in the Alimentary Canal & Vesica Urinaria,  
 It is evident that Physiologists have been misled  
 in confining the contraction of  $\frac{1}{3}$  Mus<sup>2</sup> fibres  
 to  $\frac{1}{3}$ . For the bladder can contain 10ij of urine,  
 or it contracts so as not leave a single drop  
 within it. so that the power of contraction is  
 very great, or instead of shortening  $\frac{1}{3}$ , they do it  
 to  $\frac{1}{10}$  of their former size. In like manner in  
 the Alim<sup>y</sup> Canal the contraction of  $\frac{1}{3}$  mus<sup>2</sup>  
 coat is so great that the sides touch each o<sup>r</sup>.  
 so as to push Mercury before them in all the  
 different directions of the Alim<sup>y</sup> Canal.  
 Besides, We find no distinct Sphincter of the  
 bladder, but the same Muscular fibres con-  
 stituting the neck; so we can act only  
 with



with the whole at once, We can first act with the portions of the fibres which capillate the Urine, & then with the other end, and prevent the Urine from flowing.

Afterwards we observe the Canal common to the Seminal & Urinary organs, therefore we next examine the appearance of the Testes, & trace the Semen from thence forwards. Now on these parts we shall observe little at present. We observed the bundle of vessels enclosed in a Baginæ, capable of confining pain in some measure, tho' not entirely. Hence we find Local Effusions of the Synovial chond. Then at the bottom we find a shut sac, the baginal coat, which seems to have no connection with any other Cavity. We shall afterwards trace it from the Putosæum, but at present we consider it as enclosing the Testis, or serving the same purpose to them that the Putosæum does to the bowels, They are supported & defended by it, and allowed to



to slide easily. And in proof of this we shall find, That the Testicle is originally within the Abdomen, & while it remains there it wants the vaginal coat, the Piston<sup>m</sup> supplying its place. Now, we find the Tunica Albuginea covering the Testicle, and we may trace the vaginal coat over the Albuginea, forming an External Layer to it, so that the Tunica Albuginea is just the continuation of the vaginal coat, but besides there is a proper coat of a pale<sup>r</sup> whiteness & of great strength, which seems to conduct vessels to the Testicle.

These two coats are next covered with the Cremaster Muscle, which not only sustains, but serves to agitate and compress the Testes. and to promote the secretion as well as the excretion of the Semen. Now all we find a cellular substance connecting these coats to the Skin, this is loose and without fat, which might compress the Testes too much.



433. May there is some reason to believe, That ye  
fat may be wanting in order to admit of a  
contractile power, which the skin in general  
possesses but which is most remarkable in  
this place; & this part of the skin is more or  
less contracted or loose according to quantity  
of Semen in the Vesicula Seminalis, which  
shows that there is a Muscular power by  
which that change is produced. So the  
Semen is conducted from the Epididymis  
to the Vas Deferens, and by these to the  
Vesiculae, from whence it is conveyed to  
the beginning of the Utricle, whence liquor  
of the prostatic gland is poured out. We  
next opened the Utricle & saw the Glands  
of Cowper, the uses of which are not well  
known. Within the Utricle we found  
the Muscular Duct, with the orifice turned  
forwards; the plain use of which is to  
defend the Canal against the acrimony  
of



of the urine, and they are disposed with the  
orifices pointing to the mouth of the Urethra  
that the urine as it comes forward may empty  
them, so it becomes a defence for the ducts at  
their mouths as well as to the membrane  
in general. You have seen a <sup>white</sup> <sup>creamy</sup>  
substance, & bulb forming the glans, and  
I show you that substance which forms  
the body of the Penis, which does not  
communicate with the glans, there is  
a semaphorus between them, & the cells  
containing the blood are covered by a  
Membrane of great strength & elasticity.  
The manner in which the Penis is dis-  
=tended can only be understood when  
we have seen the course of the vessels.  
Sect. 35<sup>th</sup>

Sept. 33<sup>rd</sup>

We now come to examine the structure and contents of the Thorax. In the chest are contained the Heart with its great vessels, and



and the Lungs. We may blow up the Lungs very readily by means of a short pipe introduced into one of the Testicles, the extremity of which being conical so as to fill the Testicle exactly. And as the force with which one expires is very considerable, We may readily inflate the Lungs by blowing thro' such a tube, & it is unnecessary to use a pair of bellows for this purpose. To prevent the air from going down into the Stomach, We make a pressure on the Oesophagus at the bottom of the Larynx, where y<sup>e</sup> cricoid cartilage makes a complete circle, whereby You don't prevent the air from going into the Lungs.

It is also practicable by a tube to throw liquors into the Stomach as in y<sup>e</sup> case of a Paralysis of the Throat. We pass a common Catheter down to the Oesophagus & applying a Syringe, We can throw any determined quantity of liquor into the Stomach, and We



We should not take more time than can  
be allowed by interrupting the breathing.

Lect. 36<sup>th</sup>

The demonstration continued

Lect. 37<sup>th</sup>

We have now examined so far as can be  
done by dissection, The structure of the Heart,  
of the Lungs, and of the containing parts;  
Let us now consider their general use and  
motions.

As the Heart is the Centre of our vascular  
System, which we are afterwards to consider  
very fully, I shall at present confine myself  
to a few remarks respecting it as a Muscle,  
and striving to explain more fully the demon-  
strations that has been made, and the constant  
general use of its parts.

We find it enclosed in a large capsule, called  
its Pericardium, and this was observed was  
fixed in its place, just by the two Pleurae  
where



437 Where they form the Mediastinum, then  
We find it connected below to the middle  
of the Diaphragm. We were led then, from  
considering this, to consider the Pericardium  
as serving to fix the Heart in its place,  
to prevent the weight of it from drawing  
down so much the large vessels, whether  
Veins or Arteries going into or from it, as  
also from falling to the side so much as  
to disturb the lungs or other organs in the  
performance of their functions. When We  
open the Pericardium we find it well fitted  
for this purpose by its strength. We next  
observe it passing over the heart, closely  
connected by the Muscular fibres, in order  
to prevent the rupture of these, and to confine  
the blood within the heart; and this reflects  
of it may serve the further purpose, of  
preventing the bare flesh of the heart from  
being rubb'd against the other Capsule, which  
would



would have felted and united them;  
 and the whole inner side has a liquor found  
 into it, by which it slides & plays the more  
 easily. We next attend to the situation of  
 the heart, and we have found that in the  
 human body it is somewhat of the shape  
 of a half cone laid almost transversely w<sup>th</sup>  
 the flat side upon the Diaphragm, and  
 that the parts nam'd Right & Left should  
 be call'd Anterior & Posterior. This w<sup>th</sup>  
 that every part of the Heart, the Auricles  
 as well as the Ventricle, are Muscular, and  
 cutting into the Heart we find the muscle lined  
 with a very thin membrane, which evidently  
 serves for confining the blood. Next we observe  
 that the texture of the Heart is very close, the  
 fibres are by no means seen so distinctly as  
 in the large Muscles, and they are more  
 closely connected by cellular substance, &  
 this close connection serves to prevent the  
 blood



1239. Blood from passing out between the fibres  
when the inner membrane is lacerated, and  
from the difference of texture there seems to  
be a further real difference in the nature of  
the substance, that it is more highly sensible  
and irritable, and that it possesses peculiar  
powers of contraction. For this power is very  
different in different muscles according to  
their use. So that it is wrong w. Physiological  
Writers in general to place a certain bound or  
limits to the contraction of Muscles. Thus  
the hollow bowels within the Pelvis possess  
much greater powers of contractility, than  
the containing parts do.

We next trace the several parts & follow  
them in the order in which I shall prove  
the blood is moved. We begin w. the Vena  
Cava. The meeting of these called Sinus  
Venosus Porta, is evidently a mixed substance,  
and the ends of the Cava participate of the  
same structure, possessing the same power of  
contraction with the Trunk. Joined to the  
Trunk



440.

Sinus we find an Appendix projecting from  
the heart named auricle and we distinguish  
between these merely by the Disposition of the  
Muscular fibres. In the sinus the fibres are smooth,  
whereas in the auricle there are a number of  
columns carnea, with interposed. Not at the  
same time we are to consider the auricle and  
sinus as making one & the same Cavity, wh  
is filled & emptied at the same time, for  
there is no sort of Valve or partition between  
them. The Left sinus is much larger than  
the Right, and the Left auricle much smaller,  
or looking to the left side, that auricle is an  
inconsiderable Cavity when compared with  
the sinus.

Going further we find the Venetricle of the  
same general structure with the auricle,  
that it has columns carnea with sinus  
and spits between them. The several pillars  
securing the blood between them, when thrown  
into action agitate it more violently, and  
in this way serve for further purposes.

(These



441. Where the Annule is joined to the Ventricles  
We observe a ring of a dense firm substance  
from which the fibres of the Ventricles begin, and  
having thus perceive a most beautiful  
structure of fibres, mostly oblique, mixed with  
others that are transverse. And we found  
within the Ventricles that the opposite sides  
were joined with pillars, or that the Heart is  
calculated to lessen all its Dimensions. It  
was supposed to be merely drawn down, so as to  
become longer. This mistake arose from observing  
that when the Ventricles are acting the points  
within the ribs, but this depends on this circumstance,  
that whilst the Ventricles are acting the Annules  
behind are falling and bringing them forward,  
but the chief circumstance on which this  
depends is, that the Heart while the Ventricles  
are empty, makes a turn, moves upon the  
Basis where it is tied down by vessels, as upon  
an Axis, and the point falls towards between  
the two lobes of the lungs on the left side, and  
it is evident that it is less in all its Dimensions.  
Ab



At the joining of the Atricle and Ventricle there is a valve, which forms near a complete circle & named Tricuspidis, but a name Circular would convey a more exact idea of it. We find this connected to the side of the Ventricle by fleshy pillars which have tendinous chords connected to them. The use of the Valve is evidently to hinder the regurgitation of the blood, but the use of the pillars is not so evident. Tho' it may be said to be this, when the Heart is in action, the point of its approaching its basis, if the connection had been made with Membranes, they would have been turned inside out, & thrown back into the Ventricle, so would have allowed the blood to have been thrown back into the Atricle. It is ridiculous to think these pillars serve to open the Valve. After the Ventricle has ceased from action, the blood makes way for itself, & is hindered from only by the action of the Atricle. This Valve then directs its motion, & prevents the return, so when the Ventricle is in action the blood is thrown into the



144<sup>B</sup>. The return, and here the return is prevented by  
the three Semilunar valves; These are formed  
by the doubling of the Internal Membrane, &  
into this doubling there is a small substance  
which serves to shut the very middle of the valve.  
Then the blood returning by the Pulm<sup>y</sup> veins  
enters the left side of the heart, where we find of  
same kind of structure repeated. After it gets  
into the Left Ventricle, its return is prevented  
by the Valvula Mitralis, so it passes on to the  
Aorta: and here again its return into the Ventricle  
is prevented by the same Semilunar Valves.

So we have now followed the blood in the  
Circulation as described, for it is now carried by  
the Aorta to all the different parts of the body,  
& is returned again to the Heart by the Vena Cava.

We next proceed to turn our attention to  
the Lungs & the motion of the Thorax, & here  
as we neither can follow by dissection on the  
blood vessels to their minute divisions,  
nor even the air vessels to their termination  
I am to speak of the structure of the lungs  
only



only the most superficial manner, and  
 rather to attend to the most general motions  
 which are performed. When we dissect  
 the Trachea arteria, we find an outer &  
 inner Membrane, between these cartilagenous  
 rings, which are wanting behind, with a  
 number of glands. The want of cartilage  
 in the posterior part is easily explained,  
 First, the soft parts of the Trachea make  
 room for the Oesophagus & descent of the  
 food and allows the Trachea to be elong-  
 = ated in the different states of respiration,  
 and of the positions of the neck, and at the  
 same time the glands make secretions  
 are exhaled. Following the Trachea  
 into the Lungs we find it dividing  
 about the 3<sup>d</sup> vertebra of the Thorax, into  
 two branches, and here the segments of  
 the cartilages are more regular, We now  
 find them behind as well as before in  
 broken pieces,  $\frac{1}{2}$  or perhaps  $\frac{3}{4}$  of the circle  
 Dis=



445  
Described, but still they are continued to keep  
the trachea free from compression. The Trachea  
is evidently of a Muscular structure, but yet  
more minute branches appear altogether Mem-  
branous, and these spheroidal tubes terminate  
in the fells of the lungs. When we blow in  
air we find the fells collected into small bodies,  
which again constitute the Lobes, but from  
a small branch there is a ready passage into  
any one lobe i.e. The Cells, or ultimate branches  
communicate. We then found that the Cells  
are covered by a proper membrane, & then  
by the Pleura & its cellular substance. The  
proper Membrane, like the Pia mater of the  
Brain descends between all the Lobules,  
whereas the Pleura like the arachnoid Coat  
passes from one Lobule to another. The cellular  
substance interspersed communicates freely with  
the cellular substance that this is Pleura  
to the sides. Around the divisions of the  
Trachea we observed black coloured glands called  
Bronchial,



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Branchial, but their use is not determined,  
and I shall endeavour to ascertain it after-  
wards as I think We may speak pretty  
certainly on that subject.

Now I endeavour to prove to You that  
the Lungs in a Dead, as well as in a living  
animal are very much contiguous to the  
Pleura, so that they exactly resemble the  
containing parts in shape, and We often  
find them in Disease grown to the side, &  
this connection is universal. And lastly  
in every Dead Animal, when we dissect  
carefully the external Muscles, We expose  
thru the Pleura the Lungs in contact, but  
on making a hole thro it they immediately  
collapse, and the reason is very evident  
Being owing to the weight of the air, the  
same effect it has upon our bodies, or on  
the surface of the earth, this single point  
need only be mentioned, and then the  
cause of the Continuity is quite evident;  
You have seen the proof of the weight of



447. of the air in the common measure. Barometer  
Thus if we take a glass tube Three feet long, shut  
it at the one end, & having the open end turned  
upwards, and filling it with Mercury, raise  
it perpendicularly the Mercury will separate  
from the top of the tube six inches, but is supported  
about the height of 30 Inches; measuring it in an  
accurate manner, it is in the long tube 30 inches  
higher than it is in the short. Now we easily  
can find no other reason for it not running  
out, but that the weight of the air upon the  
surface of the Mercury is equal to the weight  
of the Mercury in the longer tube. Or supposing  
away a cohesion of the Mercury to the tube, if  
we make the same experiment with Water  
it would require a tube 30 Feet long. We  
are then in the same state as if the Earth  
was covered to the depth of 30 Feet with  
Water. Now making the substitution of  
the one fluid for the other it will appear  
evident, that by its weight it would reach  
down our throat, distend the lungs, and  
press



keep them contiguous to the containing parts.  
 And if we understand how the lungs are  
 contiguous in any particular state of respiration  
 we understand that they must be so in  
 every state of it. Suppose I have just now made  
 an Expiration, and that I exclude any more  
 more air will run down the Trachea, and  
 still keep the lungs contiguous. Or thus viewing  
 their dilatation we may consider them as  
 being altogether passive, and as much follow  
 the motions of the containing parts. With  
 regard to their dilatation this is perfectly  
 evident, and with regard to their contraction  
 their power must be very considerable  
 their Muscular fibres being extremely thin.

I remain then to explain the motions  
 of the containing parts. Now by the action  
 of these, the Thorax can be enlarged, beginning  
 with the action of the Diaphragm. This we  
 find convex towards the Thorax, and in  
 its middle we find a tendon which ties  
 it to the Mediastinum & Pericardium, but



149.  
From this place to the sides of the Thorax, it is  
perfectly free from Adhesions.

When it is thrown into action it is brought  
from a crooked to a straight line, and as its  
circumference is nearly immovable, it must  
push down the Abdominal Muscles, bowels,  
and elongate the Thorax; there is likewise a  
certain degree of elongation in the middle,  
the Sternum yielding to the force of the  
Diaphragm: but it is the sides of the Diaphragm  
which move chiefly, and by means of  
this the Two Pleura are made longer, &  
the Abdominal bowels considerably compressed  
or the Abdomen made shorter. Next the  
Thorax is enlarged by the motion of the ribs,  
and these when moved have a double effect.  
First, the Sternum is lifted forward, & brought  
to a greater distance from the Spine, thence  
the Depth of the Thorax is increased, and this  
is owing to the Oblique situation of the ribs  
as they are placed slanting in the Thorax.  
Next



Next, the Distance between them is increased and they are thrown outwardly, partly owing to the Elasticity of the Cartilage rendering the motion. Hence by the motion of the ribs the Thorax is increased in Depth & in breadth, or we can enlarge them all the dimensions in which it is possible to increase any other solid substance.

It only remains that we determine the power by which the ribs are moved. and here Authors have perplexed themselves very much, from not attending to the particular use of Oblique fibres in the intercostal spaces, and from not rightly understanding the right use of the two rows of intercostal muscles and the two rows are given because of the Obliquity. I apprehend that very Effectually can be removed with the greatest ease, and one general point of much consequence in our body is explained by it, namely the great effect which oblique muscles have in



in performing a more extensive motion,  
 than is possible to be done by means of  
 straight fibres. Thus suppose a large flexion  
 of the body is intended, and That I want to  
 draw the Enosiforme Cartilage very near to  
 the Os Pubis; than can be very well done  
 by the Musculi Recti; suppose these are 10  
 inches long and That they shorten  $\frac{1}{5}$ , so  
 that when they act the Cartilage enosiformis  
 is brought down two Inches. But suppose  
 we use two Oblique Muscles of 4 each length,  
 and That they contract in the same manner,  
 this Cartilage will now be brought a great  
 deal lower, the obliquity of the one balancing  
 that of the other, the Cartilage is brought, or  
 moves in the Diagonal line between them.  
 and instead of moving two inches only, it  
 may be made to move 8. That is 3 times  
 more than it did formerly. Now with  
 respect to the Intervestred Muscles, their  
 large motion depends upon this entirely.  
 The



The spaces are so small that a straight fibre could not have given sufficient play. Further, if there had been only one row of oblique fibres, the ribs would have been drawn either too much forwards or backwards, the motion would not have been equable; but by moving in two rows, the extent of the motion is preserved, and is made perfectly equable, the ribs moving parallel to each other. And as the upper ribs are more fixed than the under, when the Inter costal muscles act, there is a general motion upwards, the lower rib moves towards the upper, and from top to bottom they move in this uniform manner; so that Dr Witherstone was mistaken supposing that the under ribs pulled downwards while the motion of the upper ribs was directed upwards, for they all move in the same direction.

All the Arteries from the cat-Intercostals  
are.



are wanting and the External are wanting behind, and this reason of this is simple.

If the external had been continued to the Sternum the last fibres would have been fixed to a less moveable bone below, and to a rib above, therefore instead of assisting in raising the ribs they would have pulled them down, & hence as soon as the External Intercostal muscles approach so near that from their obliquity the fibres would have been in danger of influencing the upper rib more than the under, they are laid aside & carried no further. In the internal intercostal muscles that proposition is reversed, in consequence of their direction, and the angle which the ribs make with the Vertebrae, they would have come at length to influence the upper rib more than the under, when they would have been not only useless but even hurtful; and from this view we are enabled to refute an error which has crept in, that the external & Internal Intermuscles are



are Antagonists to each other, That the External  
elevate the ribs, while the Internal Depress  
them, whereas it appears from this that they  
are intended to co-operate; and without using  
further arguments I have seen this co-operate  
in living Animals, & it has been long ago  
very justly described by Dr Haller.

Now after knowing the general effects  
of the Intercostal muscles, & of the Diaphragm  
and of course the Dilatation of the Thorax,  
We will also understand what is done in  
the time of Expiration. After a short space  
We grow uneasy from the Distension of the  
Lungs, & expiration becomes necessary, but  
when We expire we act with less Muscular  
power, the elasticity of the parts assisting  
very greatly to replace them. When We  
lie in a horizontal posture, as soon as  
We cease from acting with the Diaphragm  
the very weight of the Abdominal Viscera  
Dis-



1455. Distended with raised air, w<sup>th</sup> the action  
of the Mediastinum which is put upon the  
sketch, helps somewhat to replace y<sup>e</sup> Diaphragm,  
and the elasticity of the Cartilages of y<sup>e</sup> ribs  
replace them, but we assist still further with  
the Abdominal muscles, when y<sup>e</sup> Diaphragm  
descends it pushes them gently out, and as  
soon as it is relaxed we push in the Abdominal  
contents to replace the Diaphragm by that  
means, and as the external & Internal  
diaphragm are connected to the edges of y<sup>e</sup> ribs  
these are drawn at the same time. Some  
few other muscles are immediately intended  
for the purpose of Respiration as the Tri-  
-angularis Sterni, which serves to pull  
down the ribs, and we find at y<sup>e</sup> roots  
of the ribs two Serrati muscles, one at y<sup>e</sup>  
upper part, serving to raise and fix  
the ribs, and the other part serving to  
pull



pull down the undiaphragm, which stand  
the more in need of a muscle for that purpose  
that they want the connection of the  
Murmur by intermediate fast ligaments.

Knowing the usual respiration, We  
can understand every modification of it,  
as Speaking, Coughing, Laughing, sneezing  
yawning &c We need only to perform these  
motions slowly to understand how the  
Muscles act.

Next, We understand the use of the  
Mediastinum. A Wound made into the  
Thorax of a sound Animal must be at-  
-tended with a high degree of Danger, from the  
air being applied to the outer side of the  
Lungs as well as to the inner, & their  
Natural elasticity causing them to collapse;  
and this Danger is lessened by the Mediastinum  
If one wound only be made, the air has  
not access to both sides, one only is affected.  
But



45<sup>th</sup>. But besides as our two lungs are joined by  
one common pipe the Trachea arteria, the  
motion of the one side affects the other, and  
the motion now in the Wounded state  
becomes complex, but is easily understood.  
When a wound is inflicted on one side of  
the Thorax the lungs on that side endeavor  
to fall together, and the Animal from an  
instinct of Nature endeavors to prevent  
this, & makes a full Inspiration, whereby  
the wounded side is Dilated more or less,  
Next, the Animal makes the inspiration  
with equal violence employing several  
other Muscles which we can occasionally  
bring into play, and during this expiration  
there is evidently a contraction of the Glottis  
which does not allow the air to get out  
and falls upon this expedient to keep in the  
air, so that it passes from the sound side  
into the Wounded, when therefore the one  
side



side of the Tongue is expiring, the other is in a state of Delatation, & by that means, Life can be preserved tho' the wound is fatal.

We must proceed to Demonstrate the Muscles of the Mouth & Jaws as also some in the neck. There have been violent disputes about the action of the Digestive Muscle, when We open the mouth it is slacken'd, so Albinus justly contends that it is one of the Muscles and a principle one which pulls down the Under Jaw, but when We prevent the Digestive Muscle from opening the Jaw, by acting with the Pterygoid & Masseter muscles it assists in Swallowing, as soon as the food is prepared We shut the mouth, press the Jaws together, and pull up the Es Thyoides with this Muscle, so that Albinus has erred in assigning its office in this particular circumstance.

Self.



Sept. 28<sup>th</sup>

We next attend to the Co-operation of the  
 several muscles demonstrated, and we begin  
 with the Muscles of the face. These you will  
 observe perform a double office. First. They  
 are intended for the expression of the passions,  
 and I apprehend that from the reason of the  
 thing we would be led to say, contrary to  
 the late Dr. Parsons, that we do not acquire  
 the power of expression by habit, but that  
 as Madamitt, the manner of men vary originally  
 so we would suppose that the Muscles of  
 the face do so likewise, and I think we may  
 further attend to two circumstances in proof  
 of it, one is, that the faces of children vary in  
 expression very greatly. Next we may observe  
 that not two of the most accurate Anatomists  
 agree in the Descriptions they have given  
 of these muscles, & I have observed that there  
 is a natural variety, but without being  
 altogether satisfied of it, that habit however  
 has



100  
that its influence must be acknowledged.  
This appears from the sameness of expression  
among men of the same profession, and who  
are intent on the same objects, which make  
at last an indelible impression on their  
features. We next attend to their more  
simple operation in shutting or opening the  
mouth. All the several muscles said to  
raise the lips, or to draw out the corners of  
the mouth acting at once, open the mouth  
freely. We next endeavour to open the  
Jaws, and we do this chiefly by extension  
of the under jaw, tho' not entirely, for if the  
Lower Jaw is prevented from motion, we  
can raise the whole head & by that means  
influence the Jaw. We usually however  
act only with the Muscles of the under  
Jaw, and of these the Digastric is the simplest.  
but along with that we may employ the  
Mylohyoid & Geniohyoid, and to render this  
motion very extensive, we draw down  
the



161.

Muscles Hyoides by the Muscles from the  
Shoulder blade & Thymus, whereby we  
 alter the Angle of the Digastric, being drawn  
 at a greater one into the Jaw. Next we shut  
 the Jaws, and make them play on each other  
 by the action of the Masseter, the Temporal  
 and Pterygoides, these draw the jaw upwards  
 with some degree of obliquity; the Masseter  
 draws it upwards & somewhat forward,  
 the Pterygoid upwards & a little inward. so  
 these three when in action make the Jaws  
 approach, and give at the same time some  
 degree of play the one upon the other. When  
 we are acting thus with the Jaw bone there  
 is a necessity that the food should be confined  
 on the outer side, to prevent it from getting toward  
 the Chin and Gums, and to do this we act  
 with the Pressinator, and we shut the mouth  
 with the Obicularis, whereby the whole sur-  
 -face is closely applied to the teeth & gums.  
 You will observe that the Obicularis helps



a very extensive contraction, I can thrust  
 all the fingers of both hands into the mouth, &  
 the next moment I can entirely shut it, so  
 this muscle instead of extending  $\frac{1}{3}$  shortens  
 to  $\frac{1}{3}$  of its length. Further, the fibres which  
 shorten the mouth, in a great measure form  
 it so we not only act with single bundles,  
 but with portions of the same fibre at pleasure.  
 Whilst by means of these muscles, avoiding  
 others mentioned by Bowdich &c we confine  
 it on the inner side by the action of the Tongue,  
 which can be varied in all directions at  
 pleasure, in more directions indeed than  
 appear possible from a view of the Muscles  
 without taking into account the power  
 which it is here supposed, that is extremely  
 of the fibres act at a different time and in  
 a different manner from their beginning &  
 their direction can be altered at pleasure.  
 After the food is sufficiently prepared  
 for being swallowed, we convey it back  
 into



468.

into the throat by bringing it on the tip of the  
Tongue, then drawing it backward, by  
means of the Stylo-glossi muscles, which at  
the same time make it broader, and we  
raise its point by the action of the fibres whi  
compose its substance, chiefly by the lingualis,  
whereby the point is pressed upon the palate,  
and by the assistance of the lingua it easily  
passes to the root of the tongue. While the  
Tongue is thrown back the larynx connecting  
it to the Epiglottis, comes to be relaxed, and  
the Epiglottis is mechanically pressed down  
on the top of the Glottis, by which means  
it is shut most accurately. Next we endeavor  
to get rid of the food which now obstructs  
respiration by drawing the parts upward  
and forward, and we are obliged to  
leave the Glottis better by the irritation whi  
is communicated to the Uvula. I do not  
know of any Anatomist who gives a  
distinct account of the use of the Uvula,  
It



It appears rather an impediment, but it is highly sensible, and by pushing it a great motion is caused in the Throat, so it is hung there as a Monitor to oblige us to perform that Contraction which shuts the Glottis in passing the food over the Pharynx. And is wanting in the Quadruped, where from their horizontal posture there is not the same danger of the food falling down on the Lungs. We then lift up the Glottis by the Levatorius Schenchi-furcatus, and pull forward violently the Os Hyoides with the whole Larynx, and while we are attempting to swallow, the Larynx are fixed for preventing the Muscles from pulling the Larynx down, that their whole action may be on the Os Hyoides, some act with the Genio & Mylo Hyoidae, and with the Digastric which is at the same time drawn into a Convulsion with sudden violence. We now draw these Muscles into very sudden action, and by their means draw the Larynx forward.



465.  
forwards. Thus We throw the food backwards  
and at the same time prepare the space for  
it, because the back of the Tongue makes the  
fore part of the Pharynx, so that the arch behind  
is adapted for the reception of the food.

When the food is pushed behind the Epiglottis  
there is danger of its passing upwards into the  
Nose; and this is not prevented by our erect  
posture merely, for if the Palate is eroded  
as in the Guinea, the food & the Drink  
fall into the Nose, and We can swallow  
liquids when standing on the crown of  
the head. So this is provided by the great  
power which the Locusts Palate have  
by which the palate is applied in an accurate  
manner to cover the back of the Nose.

The food being thus thrown with a  
considerable push <sup>into</sup> the Pharynx, that  
organ is called to act, and is rendered  
stouter by the Palate & Hylo-Pharynx's  
muscles, which lift it upwards within  
and



and at the same time Dilate it, The  
 Distance between the Hybrid processes being  
 greater than the Diameter of the Pharynx  
 these muscles must Dilate it. When the  
Constrictor Pharyngis are thrown into action  
 and by an instinct of Nature the motion is  
 is returned from above downwards till  
 the food enters the Esophagus, and we now  
 release the parts there being no danger of  
 the food ascending again. But if we are  
 to thrust it in with great violence, we can  
 throw the Esophagus & Larynx backwards by the  
 Esophagus muscles, and we see the reason  
 why Muscles go from the Scapulae to the Esophagus,  
 they serve to pull the Larynx  
 backwards in an oblique direction. By these  
 means the food is thrown into the Stomach,  
 with more accuracy & with greater quickness  
 than you are aware of. In ruminating  
 Animals as in the Cow, the bolus passes so  
 quickly from the Mouth to the Stomach,  
 that



464 That we scarcely see it in the Throat, and the  
no doubt possess similar powers. We can also  
force breath into the Monach when the head  
is inverted is the order of the Larynxes and trachea  
to burst, or we can push air into the Monach,  
and I am very much persuaded that Persons  
who have weak Monachs, and often much  
to their disorder by swallow a vast quantity  
of air; they complain of wind, & much of  
it is discharged by belching, and the whole  
of it is not from food. I have attended to  
several who have been in this situation, they  
find an Uneasyness, the food becomes sour, &  
& they make an attempt to free themselves  
of this Uneasyness, but they add to it by  
swallowing the air, and indeed I can  
swallow such a quantity of it that my  
Monach is in danger of being burst by it.  
While Deglutition is thus performed the  
Salivary Glands are at the same time  
agit.



agitated in a way that is proper & useful.  
 and from this situation a much greater quantity  
 of Saliva than usual is poured out in time of  
 eating. Thus where wounds have been made  
 in the Parotid gland, the quantity is such,  
 that not only the excretion but the suction  
 of the liquor would appear to be increased.  
 In like manner in the Throat, some is added,  
 by the pressure made on the tongue & uvula,  
 and this is done chiefly by the action of the  
Constrictor Pharyngis.

Next, with regard to that reverse motion  
 Vomiting We generally get from Authors a very  
 wrong account of it. They suppose that the  
 Stomach first has its proper action inverted  
 and this indeed does somewhat, but it  
 is surely not sufficient. Next they suppose  
 that the Abdominal Muscles & Diaphragm  
 are at the same time thrown into converse  
 action



469.  
action, and that the Stomach is pushed between  
them. When this case the air rushing into  
the lungs would meet the liquor from the  
Stomach, and both at once would be thrown  
into the lungs. The action of the Diaphragm  
precedes that of the Abdominal muscles, &  
after we have filled our lungs with air,  
making a certain resistance w<sup>th</sup> the Diaphragm  
we throw the Abd<sup>l</sup> muscles into action, &  
allow them to overcome the Medium, so the  
Water and air are thrown up at the same  
instant of time.

### Lect. 3<sup>d</sup> of the

It is of use to observe that the finger is long  
enough to be passed into the Throat, and that  
we can touch with it the back of the Oesophagus  
Stomach, and by this means we can well  
examine the communication of Tumours in  
the Throat. With the finger we can also  
feel



170.

feel the Epiglottis, so instead of blowing in  
air from the Nose to the Lungs, if the person sus=  
=pects it is getting down into the Stomach We can  
enter a Catheter directly into the Trachea, and  
thus without hurting the parts of y<sup>e</sup> Larynx.  
We enter the finger of the Left hand at the  
right corner of the Mouth, till we feel the  
Epiglottis, & placing the finger on the back  
of it, We enter the Catheter at the other corner  
of the Mouth, and this is very easily done.  
But as by doing this in a hurry we may be  
in danger of tearing the Oesophagus, it is better  
to Inflate them from the Nose.

I observed that in Mastication and  
Deglutition the numerous small salivary  
glands are compressed. When we open the  
mouth the muscles in action press the Inferior  
Maxillary glands & the sublingual, while  
the Tongue prevents them from sliding y<sup>e</sup>  
Most of these muscles, at the same time the



471.

The Saw on being pushed back, prepares upon the Parotid Gland, the duct of which are pumped by the Masseter muscles. The saliva is also poured out from the Amygdalae from a number of orifices which communicate w<sup>th</sup> each other, they are supplied by the food passing thro<sup>ugh</sup> the isthmus of the Fauces, and the saliva comes to be mixed with the Bolus. You will observe further with respect to these Amygdalae that the saliva is often undissipated in their receptacles, and appearing at the orifices has been mistaken by Physicians for sloughs in the Throat, and as of a dangerous nature, when in reality there was nothing very dangerous in the case.

We next examine the Muscles of the Larynx—

All Anatomists agree that the voice is formed at the Larynx, or that we shape the voice into Letters by means of this  
 Org<sup>n</sup>.



Organs of the Larynx, as it passes  
 thro' the mouth. It only remains to  
 determine the particular way in which  
 this is done.

Till of late that M. Farcin an ingenious  
 French Academician wrote on the subject—  
 Authors spoke of the formation of the voice in  
 a very vague and indetermined manner. He  
 first endeavoured to throw light on the subject  
 by Experiments. Before them they generally  
 conceived the voice to be formed by the Larynx  
 considered as a wind pipe. Instead of which  
 M. Farcin contends that our Larynx is to  
 be considered as a folded instrument acted  
 upon by the wind. Now that is a distinction  
 very happily understood. Do not observe that  
 in the wind instrument, as a flute, the  
 tone depends not upon the materials of  
 which the instrument is composed, but  
 upon the shape, the size, and the apertures.  
 Thus a number of flutes made of very  
 Diff-



473.  
Different materials, as lead, copper, Wood  
Paper &c may be all play'd in Concert, where-  
- as in the corded Instrument, as in a Fiddle,  
the tone depends not merely upon the strings  
but also on the Materials composing y<sup>e</sup> body  
of the Instrument. &c. Now that point being  
settled, let us see how the tones are formed  
in our Larynx.

M. Marcin alleges that they depend on  
the Ligaments entirely, that these are the  
chords which form the sound, and He has  
certainly shown that they contribute in a  
very high degree, because in Animals when  
recently dead, after the tips of the Arytenoid  
Cartilages are cutt off, and the Ligaments alone  
left, the voice of the Animal can in some  
measure be imitated by forcing out the air.  
I shall show this afterwards in Fowls where  
the voice is imitated more readily. So He  
alleges that the chords alone form y<sup>e</sup> voice,  
and that the Aperture serves to increase y<sup>e</sup>  
strength of it. Now tho' this Gentleman  
hears



174.  
treats of this subject more clearly than other  
Authors, and, fond of his invention, We carries  
matters too far, and it will be found that  
the Vibrations of the other parts, and of size  
of the Aperture. Likewise contribute. Or that  
our Larynx is not only a Corded, but a wind  
Instrument. In proof of this I will assure  
you that the Neighbouring parts are well  
calculated for Vibrations, particularly the  
Cartilages of our Larynx, and in general  
the Cartilages of the Trachea. Or let us see  
what is done when We form very grave, or  
acute tones, by applying the finger to the  
part; If the Motion depended upon the  
Ligaments of the Larynx, these alone wd  
be acted upon, but instead of this I release  
the whole Throat for a grave note, and for  
an acute one, not content with drawing  
up the Os Hyoides, I at the same time  
make a full inspiration, pull down the  
Diaphragm as far as it can go, that the  
weight



weight of the air may stretch the Lungs, & all the branches of the Trachea; which cannot be explained on the principles of Aerics.

Or make the Experiment on Birds, in that kind of Animals the Ligaments of the Larynx, and those organs forming the aperture into the Trachea, are placed at a distance from each other, the former being at the top of the breast, and the latter at the top of the Trachea. Now I have cut the Trachea in a young bird, & not only the strength of the voice, but the tone was altered by the Incision. Or observe what happens in whistling: Do not we perceive that we not only give the tension, but that we alter the Aperture. And in the last place do we not perceive that Nature has amazingly fitted our Muscles for altering both the tension & Aperture. So I would conclude that our voice surpasses this advantage over all Instruments that it combines the wind & Corded instrument together, and



and next that the chords instead of being  
acted on by solid bodies are acted on in a  
more equable way, & of which we have the  
full command by the air thrown out by  
the Lungs. — We next proceed to examine  
the Muscles which move the head upon the  
Trunk &c. We do not find any two  
Anatomists agreeing in the Description of  
many of these muscles, which depends  
upon two Circumstances. First We can't  
separate many of them into the portions which  
are divided, without breaking sev. muscle  
fibres, and following the muscle into the  
Vertebra it becomes tendinous, which passes  
to another bone, & it is made use of by  
Nature as a Ligament. Now some describe  
the insertion according to the place first & last  
connected, while others trace the fibres further.  
Upon the whole Albinus has given by  
much the most accurate Division, but he  
has



474  
has unluckily taken the fancy of Describing  
the bones in a different way from all other  
Anatomists. Instead of beginning at the head  
He chooses to begin at the reverse way from  
the bottom upwards, and while he enumerates  
the bones this way. He reckons the ribs in  
the common way from above downwards.  
But his Divisions & General Descriptions are  
excellent, and we find but very little room  
for Addition. We also Demons<sup>trate</sup> & Models  
of the Upper Extremity connected w<sup>th</sup> the  
Trunk.

Spec. 40 Mo

Let us now attend to the combined action  
of these Muscles. We have seen a great  
many Muscles, which are chiefly intended  
for the Motion of the Neck but few of them  
are upon the forehead, because the muscles  
of the Jaw from the Condyles of the occiput  
form the Centre of motion. When we act  
only with the Muscles proper to the head,  
the diff<sup>erent</sup> degrees of obliquity of the Muscles  
Masloz



Massetores muscles ballancing each other,  
the head is thrown forwards; and so with  
respect to the muscles behind; and in general  
you will observe that the obliquity extends  
the motion. If act with the Muscles of  
one side, whilst I bend the head forward,  
I turn the face to the side, & alternating the  
action I give a kind of rotation to the  
head. In the manner on the back part  
I either with the action of all the Posterior  
Muscles draw the head strongly backward,  
or acting with the Oblique muscles of the  
opposite side I give it a rotation. As to  
make all the motions which we are capable  
of performing with the head, I bend it  
straight forwards by the Anterior straight  
muscles, and backward by the Posterior,  
but as the side I employ an Anterior and  
a Posterior Muscle at the same time, so if  
I want to press the ear down upon the  
shoulder, I employ the Mus. Massetores &



479. & Splenius, suppose of the same side. The obliquity of Sternocleidomastoid that of the other, the head is moved in the Diagonal between them, and by a succession of these I can make my head describe a circle. There is too a remarkable rotation upon the Tooth-  
= like process of the 2<sup>d</sup> Vertebra, and we can make it, with a fewer, or with a greater number of Muscles. For giving the head its full swing, I act with the Sterno-Mastoides, then with the Splenius of the opposite side, also the Trachelo-mastoides, & Inferior oblique joins in this action, and I can throw into assist, the Complexus, but I chiefly act with the other Three.

The action of the Muscles of the neck, and of the Throat is more simple, because there is no Contivance for a free rotation. We only twist the Vertebra somewhat, and if we are at a loss to use force with 4 muscles of ye neck or back, We bring to our assistance  
other



other muscles. So We assist in the flexion with  
 the Muscles of the head; and at the knee joint  
 if we are at a loss, we call on to our assistance  
 the Abdominal muscles, especially in order  
 to twist the body. When We want to twist  
 the loins we do it by the External Oblique, &  
 the Internal of the other side having of same  
 direction, We use the two as one Diagonal muscle.  
 And the number of muscles is gradually  
 increased as We go downwards, as the upper  
 part of the body is gaining a longer lever, &  
 there is an addition made by the bowels  
 to the weight.

Now, next let us attend to the motions of the  
 Scapula. Authors before Winslow used to  
 speak of the motions of this bone, upwards,  
 downwards, backwards & forwards. Winslow  
 has added to these a Motion of the Scapula,  
 and find of this observation he carries things  
 too far, respecting the direct motions. May further  
 We ins with regard to the direct manner of  
 the



481. The rotation, We conceive it to roll on an  
imaginary axis, just thro' its middle; but  
from its connection with the Clavicle it is  
impossible it should do this, We make the  
Scapula roll on the end of the Clavicle, wh  
is the real centre of its motion, next we roll  
the Clavicle itself on the top of the Sternum.  
But that we can perform the motions up & d  
Downward, backward, & forward, is so well  
that we all experience it, and we can point  
out the muscles that are fitted to perform  
it. Just the Trapezicus joined to the Elevator  
Scapulae make the motion upwards, the  
obliquely of the one balancing that of the  
and preventing the rotation. Next the whole  
Trapezicus being at once thrown into action  
draws the base of the Scapula towards the  
Spine of the body. Again I mean to  
make the motion of the Scapula downward,  
the lower part of the Trapezicus, and the  
Serr-



Serratus Anticus major, Ballancing it by  
the Serratus minor and Latus Pectoral.

And by a succession of these motions I can  
move the Scapula in a circle. Next I can  
roll it when I raise the Humerus just to a  
Right Angle, the Motion of the arm is kept  
by the rotation of the Scapula, the Muscles  
being very loose yield easily, and we perform  
this action by the same muscles as of direct  
motions, but we throw them into action in  
a different manner, so in order to draw  
the Acromion upwards I employ the Mus<sup>s</sup>  
Trapezius, and at the same time girdle  
part especially of the Serratus major Anticus &c

We next attend to the principle actions  
w<sup>h</sup> we perform w<sup>th</sup> the Muscles of the Humerus.  
Two of these come from the Thunk of the body,  
hence we can either move the arm in  
general upon the Thunk, or the Thunk on  
the arm. If I mean to draw down the  
arm



arm very strongly, the large Pectoral and Scapular Dorsi will co-operate in this action so as to grasp any bundle below the arm. Next of the arm is lifted up and I take hold of a firm substance with it. I draw the body towards the arm, so if I take hold of a beam & want to draw my legs up, I bring into action these two Muscles at the same time with the muscles of the Throat.

Next, Let us attend more particularly to the single actions, or to such combinations of them as it may be useful to know, and we shall begin with the Pectoral muscle.

The effect of this is - If the arm be by the side it draws it across the breast, but if it is already raised, then it draws it down, and at the same time forwards. I shall next take the Muscle connected to it the Deltoid, and we shall find its action to be very curious; I can raise my arm by



by the force of the Deltoid alone, acting in a certain manner with it, but by using it in another way, I can pull the arm close to the side, i.e. This muscle may be brought to Antagonize itself, or one part to be the Antag<sup>t</sup> of another. I have formerly taken some pains to show that we are not under any necessity of moving all the fibres of a muscle into action at the same time. Now if the Deltoid is brought into action at the fore and back edges, which pass under the ball of the Humerus, the arm is drawn close into the side. But commonly we use it as a Levator of the Humerus, I begin the action with the middle of the Deltoid, & by degrees as all its fibres are increased on the outside of the ball, they all come to assist in supporting the arm, but we never almost act with all the fibres at the beginning of this action.

Now the use of that will readily occur to you, as my arm rises from the side supporting



1185. a weight, the weight is continually gaining  
ever, so it is necessary the Muscle should be  
gaining strength, so at last I bring into  
play the whole muscle. I assist by common  
action of the Deltoid by the Supra-spinatus  
and likewise by the Coraco brachialis, and I  
can add at pleasure the Infra-spinatus,  
or after the arm is raised I support in that  
situation by adding the two first named  
Muscles. Next, the Musculus Pectoris present  
which evidently serve for drawing the  
arm backwards, but as the tendon of these  
Muscles is fixed to the Capsular ligament  
& afterwards obliquely to the tubercle, they  
give it a degree of flexion. The Pectoris major  
gives a rotation, and in this it is assisted  
by the Scapularis Dorsi. The palm of the  
hand is turned backwards ready to grasp  
substances behind us, which is the most  
convenient situation, and it is done by  
the obliquity & turn of its tendon round the bone.  
The last muscle of the Humerus viz. The  
Sub-



Subscapularis can draw the arm inwards  
 to a certain degree if other Muscles act at the  
 same time; or if I mean to give a stroke  
 with the elbow backwards, I employ a great  
 number of Muscles at the same time. Viz  
The Latissimus Dorsi, Pectus major, Subscapularis,  
Infra spinatus, and I can bring into action  
 the back edge of the Deltoid muscle, and the  
 long head of the Triceps of the Humerus. The  
 obliquity of these muscles counter balancing  
 each other, and The Infra spinatus prevents  
 them from making the rotation, hence the  
 arm is thrown backwards. But if I am  
 to strike with a Hammer, I make the stroke  
 inwards by the Subscapularis assisted  
 with the Latissimus Dorsi, & Pectus major,  
 and I make the back stroke by the Pectus  
minor & Infra spinatus.

The Motions of the Fore arm are much  
 more limited. I make the extension of it  
 by means of the Triceps, joining with it  
 the



487. The Anconaeus. If the Brachaeus intensity  
prevents the Extension, and that I act with  
the long head of the Triceps, then I bring  
back the Humerus, or assist the muscles of  
the Scapula in making the stroke before  
described, and to give these Muscles a greater  
play in performing that action, and to hinder  
the Joint at the Elbow from being thrust, we  
first bend the Fore arm. But with the  
Muscles of the Fore arm, I can act occasionally  
upon the whole trunk, thus saving the  
Fore arm I prevent it from yielding and  
acting with the Thighs I move the whole  
body. — The Intimus Brachaeus counter-  
acts the Triceps, but is more limited in its  
motion because of its shortness, but with  
the Triceps muscle I can give a very large  
play to the several parts. First It has  
a curious effect when we pull it in a  
straight line, It turns the Palm of the hand  
upward in order to convey any thing  
to



to the organs of the senses. The next action is  
the flexion, but if that is prevented by the  
short edge of the Biceps, it is now a flexion of  
the humerus, or bends the whole arm.

If now I fix the arm anywhere, I can make it  
act on the scapula, I can make it grasp  
more on the edge of the humerus. So we  
are told of a Person who performed a trick by  
means of this muscle. He placed a cane  
between his scapula, and grasped it so as  
he could raise his body from the ground  
upon it. Now to do this he put together  
the palms of his hands behind his back,  
to give the Biceps its full strength, thus  
acting with these muscles he raised the  
scapula upon the ends of the humeri.  
And I endeavour to rest the body on the  
forearm, I put very much into the Biceps  
muscle.

I next show you the situation of the  
humerus when created. The head of the



189. The bone is generally, if not always, pushed  
forwards & downwards behind the Pectoral  
Muscle. We discover it in the following  
manner. First the Elevated arm is shorter  
than the other, passing by the socket a little.  
Next, The elbow is turned outwards, and the  
Patient finds it difficult to bring the elbow  
inwards, and We also generally find a  
difficulty in bringing the arm to the head,  
And in every case of this kind putting our  
hand on the Acromion, we will be sensible  
of a hollow under it and applying the hand  
to the edge of the Pectoral muscle We feel  
the ball roll; So that there is no difficulty  
of Distinguishing this Situation —  
Such Authors as have wrote on this subject  
have miss'd observing the principle Diff-  
-culty that attends the reduction, namely,  
the tendons of the Biceps muscle, which  
pass between the head of the bone and  
the Glenoid cavity, and are put upon the  
Stretch



490.

Stretch. If therefore Surgeons (which is com-  
= monly done) stretch the forearm reducing  
it, much force may be used without effect;  
whereas if you will observe to bend the  
fore-arm, and to press up with your hand  
the Biceps muscle, you may accomplish  
the reduction with ease —

Lect. 4<sup>th</sup>

We proceed to examine the Ligaments  
and Muscles of the Fore-arm &c

The simple action of these muscles is easily  
understood from their names. Let us next  
attend to their co-operation. At the Wrist  
from the shape of the bones we have a large  
Flexion & Extension, and we have but scarcely  
any rotation, from the length of the Points  
they lateral motions are much confined.  
Within the wrist to a side by 4<sup>c</sup> Flexor  
Radialis, Flexor Ulnaris, and 4<sup>c</sup> Palmaris  
Dorsalis when it is present. Or if I mean  
to bend my wrist fully, I bend these 3  
muscles



muscles at one time. They are the Three  
Flexors of the wrist, and by means of them  
I bring it straight forwards. In the manus  
in order to counteract these I employ the  
Extensor Radialis, with the Extensor Ulnaris.

If I mean to draw the wrist sideways I act  
at the same time with a fore & a back muscle,  
and by a succession of these motions I draw  
a circle tolerably well upon a wall.

For the fingers we find Two Flexors, and  
but one Extensor, because it is of much more  
use to bend than to extend them. But as  
we have but one Extensor, Nature guards  
against accident by joining the tendons of  
it together upon the back of the hand, that  
if by any misfortune one of them comes to  
be divided, the Natural connection may  
continue the motion of the fingers in which  
the cut tendon terminated in some degree  
tho' in a less perfect manner. Then we find  
the Tendon of the Extensor spread out broad



492.  
on the back of the hand, whereby it is less  
exposed to injury, and in some measure  
serves the office of Ligaments, giving strength  
to the Joints, and that without preventing  
their ready motion, because the tendon opens  
to allow the middle swelling parts of the  
bone to play without resistance. The tendon  
at last reaches the last bone so acting with  
the Extensor I just move the root of my fingers  
before it comes to Influence the point.  
So if there is any slipping substance in  
the hand I can turn & examine it, and  
yet without danger of its escaping, for tho'  
I open my hand a little, my finger still  
remains crook'd over it. At the wrist where  
the chief flexion is made, the tendon is  
tyed down, that it might not spring up  
and lose its effect. Next the sev<sup>d</sup> tendons  
being collected from a large circle to a smaller,  
on opening the hand carefully, the fingers  
are spread out, & the breadth of the thumb  
grad



493 gradually increased, & this is partly owing to  
the situation of the fingers which are placed  
upon the circumference of a circle, and to the  
situation of the tendons themselves. The Flexor  
tendons are tied down more carefully, because  
they pass over a greater number of joints which  
form angles, so the transverse ligament and  
the Aponurosis Palmaris serve this purpose,  
and then we find a sheath into which a  
tendon is received. Next, We observe that  
these tendons are in a great measure round,  
in order to occupy less space, & we find ye  
one perforating the other, & the Properius  
terminating in the last bone while the  
Sublimis ends in the second. So we would  
expect a free play in the Joints of our fingers  
& I find I can bend the first joints of all  
my fingers, but the greater number lose  
this power. Now originally the first Joint is  
made to yield as soon as the second, or without  
any regard to the insertion, taking them  
together



194.  
Together the Flexors move first the two last  
pieces. Now the advantage of that is likewise  
evident, that we may keep the fingers bended  
over any substance.

The Sumbricales and Interossei muscles serve  
in a great measure for lateral motion; Many  
also consider the Sumbricales as a third Flexor;  
but they take as much from the strength of the  
Flexors as they add to them, for they are rooted  
in the Flexors, but assist by the long Flexors  
we have bent the fingers as far as they can go,  
and the contraction of the muscle is not suff-  
icient by the Sumbricales increase of extent  
of the action. But the Interossei muscles may  
be employed to bend the fingers further, and  
with greater force, They are a third Flexor.  
As for the motions of the Thumb & little finger  
they are sufficiently understood. It is well  
that the Thumb is provided as an Antagonist  
to the rest of the hand, and the only thing  
remaining is the Supination & Pronation,  
which has been misrepresented. Winters  
conces



195. comes near to the true idea, but We allow  
rather too much motion to the Ulna, and  
We seem to oppose a large motion of it, but  
when We bend the arm to prevent it, rolling  
of the Humerus, and holding Olecranon fast,  
We oppose that the motion is in a line drawn  
from the head of the Radius to the bottom of  
the Ulna; so that the motion of this bone is  
so inconsiderable that it may be overlooked.  
For the Rotation We employ the Pronator  
Radii teres & Pronator Quadratus; and We  
replace the arm by the two Spinators, partly  
the Brachii, which is better calculated for a  
Rotating motion, but if we are to use very  
great force We can assist by the muscles of  
the wrist. So if we are to make a Supin  
of the hand & with force, the Brachii is a  
Supinator. We can also assist by acting  
with the long muscles that extend the  
Thumb, as what ever makes the Thumb  
approach to the Internal Condyle serves for



for the pronation, and whatever draws it <sup>high.</sup>  
to the External Condyle serves for  $\gamma$  supination.  
So the ~~flexors~~ <sup>anterior</sup> of the Internal Condyle of the  
Humerus, as in this way in the most easy  
situation of the arm the distance is  $\gamma$  least,  
and the muscles are better prepared for a  
full Flexion & Extension without passing  
much over the bones in an oblique manner.  
You will observe the effect of lying down  $\gamma$   
hands in sheaths, that the flexion of the  
fingers is thereby very considerably increased  
by a very small contraction of  $\gamma$  muscle.

Lect. 42

We next proceed to examine  $\gamma$  muscles  
of the Inferior extremities, and sit us a third  
to the very good effect of a few of these muscles.  
We move can move our thigh backwards,  
forwards, inwards, outwards, and by a  
succession of these motions we describe on  $\gamma$   
wall a figure with the foot, we likewise  
possess a power of rolling it, and we can  
exercise that power, whether the thigh be  
in



497. in a line with the trunk of the body or that  
we just bend it. To bend the thigh we  
use the Psoas muscle, and Iliacus internus  
which are like one Diastolic muscle ending  
in the Trachander. These muscles do some-  
- what more, they resemble in their insertion  
the Biceps of the arm, they are twisted round  
the bone, and if the legs are turned inwards  
their first effect is to give a degree of rotation  
to the thigh. If I mean to draw the thigh  
strongly inwards as when we are on  
horse-back, and grasp the saddle  
with our knees, we employ all the  
Musculi Adductores, and I counteract  
these by the two small Glebei, which  
are the Abductores Femoris. It remains  
to explain the rotation of the thigh.

If the thigh is in the same line with  
the body, if I mean to roll it, I employ  
all the small muscles, the Quadratus,  
Pyramidalis, Gemini, and Obturator, I  
also



also assist a little with the Psoas, and the <sup>high</sup> Thiacus internus; and acting w<sup>th</sup> small portions of the Super Glutei & Musculus Psoasidis to replace the bone. But a curious circumstance takes place when the roll of thigh in a bended posture the angles of muscles are quite changed, The Rotatores become the Abductores, and the Abductores of Rotatores. —

Now after explaining the action of the thigh, you will keep in view a circumstance, that they only act in this way when the weight is thrown off the leg but fall with the same muscles with the weight bearing down upon them, the leg is more fixed than the trunk of the body, so they all become Muscles of the Trunk, and they now roll the Pelvis on the top of the thigh bone, so with regard to Psoas Magnus, which in this case carries the body forward.

We next attend to the motions of the knee, which is chiefly a hinge, & almost entirely so



leg. So, when the leg is nearly in the straight  
line of the thigh, but if you slacken y<sup>e</sup> leg  
and bring it to a right angle w<sup>th</sup> the thigh,  
there is a considerable rotation.

The Extension of the leg is performed by four  
great muscles, The Pectus, The Vastus, and y<sup>e</sup>  
Cruentus acting all at the same time. For  
bending the leg I use the Biceps flexor, The  
Semimembranosus, & Semi-membranosus.

From their insertion you will judge that  
I might employ the Sartorius & Graecilis,  
but pulling them when the leg is straight  
they draw it close upon the thigh with-  
out contributing much to the flexion, but  
after I have begun to make the flexion  
with the other muscles, I move the Sartorius  
& Graecilis far beyond the joint, and then  
I use them as flexors, and from their  
vast length & fibres their action is very  
extensive, hence the name Sartorius  
is by no means improper for an drawing  
in the leg as Taylors do, that muscle  
word =



evidently assists — We see the intention of Nature in throwing more muscles into action as the Leg bends, and they also gain the advantage of angle in proportion to the raising of the Leg.

Now, after mentioning the most common and simple action of the Flexors & Extensors We must bend the leg and slacken the Ligaments particularly those at the side of the Joint, then We make the rotation the Flexors and Extensors give to roll the leg and we add the Musculus Popliteus. Next if I throw my weight upon the leg, these muscles of the back above instead of lifting it, they extend & bend the thigh upon it. So if I am to raise myself, I do not keep the feet out, but draw them back, bring them beneath me, then I act surely & firmly in raising the thigh upon the leg. And further, the Extensors of the Leg Excepting the Peronei, come from the Thigh, whereas the Muscles of the leg behind



501. behind are from the Thigh, and we frequently  
need them as Muscles of the whole Thigh,  
as in bending forward & to make the Pelvis  
roll upon the Top of the High bone.

I shall next show You the Situation of the  
High bone - You observe that the Ligament  
of the Femur at its head, does not merely embrace  
the Ball, but comes down upon the neck, so  
We can open into it safer than the Ball  
without being in danger of coming upon the  
great vessels & Nerves. You will remember  
further that this Capsular Ligament is very  
tense in Situations where the head of the bone  
goes inward & downward, as the Foramen  
thyroideum, and we distinguish it in the  
following manner. As the foramen thyroideum  
is not sufficient to let the head of the femur  
pass that it is lower down than the Ac-  
-etabulum, when the Luxation happens  
here the limb is lengthened. Next, as the  
Bones stand so long, the toes are turned  
a little outward, nor can we take hold of  
the



The foot or malleolus roll easily. Next, I put my hand down from the last? spinal process of the Thum, I discover a hollow at the acetabulum, and the head of the Bone projecting further in & down. It has sometimes happened that the bone has slipped up over the Pubes, and resembled a large Pubo, but the ball here may be found to roll in the hand.

Now, How are we to reduce it? I apprehend that this has been strangely mis-managed from not attending to the principle resistance. As the Difficulty of reducing the Thum is very much owing to the tendons of the Biceps, so here the Difficulty chiefly depends upon the tendons of the Triceps internus, & Pecus Magnus passing over the neck of the bone as soon as it slips out of its socket, so instead of keeping the Lig. straight, we ought to bend the Arm, and this is the first process towards a reduction. Then we turn the foot



foot somewhat inwardly because of the oblique passage of these two muscles into the Trochanters of the thigh bone. ~~The limb~~ ~~in this Situation becomes shorter~~ Then we draw the top of the thigh out, and press it inwardly; and we will scarcely need to make any extension. But cases will occur where after bending the thigh, the next thing will be to draw it away from the Pelvis.

Next We Dissociate it outwardly when the head of the Bone is covered by the Glutei minores, and where this action has not been attended to, these muscles have come to serve as a socket for the thigh bone. The limb in this Situation becomes shorter than the other, and the toes are just bent inwardly. There is also a resistance felt in making the rotation, and we feel a hollow at the Acetabulum, & the ball under Glutei.

Now



Now in this Situation as in the former We  
ought to bend the Thigh, because the Glaber  
miners are chiefly on the sketch and by  
doing so, from Abductores, they become Rot-  
ators, and so shorten them still more  
within the foot outward. Then making  
an Extension to separate the Thigh, We  
draw the knee outward, and push the  
upper end into the socket.

### Sect. 49

The Muscles of the foot with the Apparatus  
of the Inferior extremities demonstrated.  
Before I proceed to make any remarks upon  
what has been demonstrated, I must put  
you in mind of what was shown in the  
Osteology. That there are Epiphyses more  
especially at the ends of the long bones of  
the Extremities, because the knowledge  
of these is much connected w<sup>th</sup> the Articulations,  
seems to explain the security each has, of  
the readiness with which the muscles  
per-



perform their motions.

Besides the knowledge of these is of great use in practice, it prevents mistakes, and enables us to explain several appearances. Thus without the knowledge of these Epiphyses after a fall we may suppose fracture or dislocation when there is only the natural division between the two bones. It may be beat off for want of a leading mark in practice, the dislocation, we are not aware of the nature of the accident, and do not apply the proper bandages, or the Surgeon may mistake it for a dislocation, & after replacing the bones may not give sufficient security by bandages. And we can explain a number of appearances in weakness of children, as where the Epiphysis is kept by disease, or yielded to the weight of the body.

Next, We attend to the shape of these Epiphyses, in forming the articulations, or we endeavour to reduce the articulations into places, and



566.

no branch of anatomy has been treated with more perplexity than this. 1<sup>st</sup> We have seen in many places the bones joined by their edges. 2<sup>d</sup> In many other places there is a loose connection by cartilages, whenever there is much danger from a separation. And lastly the bones in many places are supported with cartilage and tied by ligament. Thus I reject the joining by flesh which obtains in the quadruped; Our scapula is tied to the clavicle, and that again is tied to the trunk of the body, & even the Is Hyoides has its ligament sent down from the head.

You will next attend to the motions we perform, and to the appearance of the joints. In many places the bone is formed into a round ball, or we find a ball & socket, & a free motion in all directions. In other places the surface of the bones is almost flat, & the motion greatly limited. But in the greater number there is a motion like a hinge; and this may be of three kinds.

in



567  
in one part the motion is on a certain axis,  
as in the Tooth like process of the 2<sup>d</sup> Vertebra.  
but for the most part the motion is in two  
Directions; and lastly we find a compound  
hinge, as in the Vertebra where the same  
bones are lig'd to one another in two diff't  
places: and where one motion is performed  
by both. Now every one of the joints may  
be reduced under the heads mention'd, &  
there is no necessity of using the terms of  
art borrowed from the Greek: Who did  
not understand the subject more than  
we now understand the application of  
Mathematics.

Now let us attend to the structure of the  
Joints. We perceive that every part within  
a joint is covered with Membrane, there  
is an internal layer of very capacious  
Sagament reflected, to make in some cases  
Peritæum in others Perichondrium; or  
to serve for containing the fatty substance  
which



which holds the glands of the Joint.

We find on the outside of this Int<sup>l</sup> layer, fibres disposed in very different directions, for what. We can only account by alluding to the extent & kind of motion; and when necessary we find the common Ligamentous fibres covered by the tendons continued from the Muscles. And without any exception we may trace the Periosteum from one bone to another; joining within to the common Ligamentous layer & without to the tendons, so the Periosteum may be consid<sup>d</sup> as one sheath enclosing all the bones and all the joints.

Next, We observe that a liquor of a particular kind is necessary for lubricating the joints, and which does not agree in its properties with any other, not coagul<sup>d</sup> when in a healthy state with acids, or with heat, and which more resembles the



The Saliva than the Chyle. The organs  
 pouring out this liquor are exposed to  
 agitation, but are defended from being  
 hurt in our common motions, and that  
 in diff. joints, in very different ways.  
 Thus let us take the great joint of the Joint  
 Elbow in the top of the thigh. The ligt  
 is drawn out by the round chord, and  
 the gland again pressed in by the head  
 of the bone. In the knee the gland is  
 conn'd, <sup>up</sup> the very moveable Patella  
 which never makes a flexion or Extension  
 without affecting it; and the Angle it is  
 mov'd by being placed between the  
 two firm bones. However, by any sudden  
 violence these glands may be injured.  
 & painful & dangerous symptoms produced.  
 So My Father met a case where the  
 gland in the socket of the thigh bone had  
 been beat in. He suspected the disease  
 but could not distinguish, a fluxation, and



510.

and after the Patient's death We found a  
Spoonfull or two of solid matter within the  
socket, and the gland was quite destroy'd.

Next, When I showed the Experiments You  
open'd the extent of the Capsules and the  
Muscle; That where operations are necessary  
You may be directed to the proper places  
for making the incisions, I am assured  
to consider the danger of such operations;  
I only take here for granted their necessity,  
that the place may be found out. Some  
are to open the joint of the ankle, We  
wd not go in at the side, but would  
penetrate where the Lig<sup>t</sup> is thinner, as  
at the fore side. So with regard to ye  
Knee, we would cut into it at the  
inner side, where the Arterious Apo-  
-neurosis is thinnest.

Next, We attend to a few gen<sup>l</sup>. Lacunae  
with respect to the Muscles. We find  
in



511. in consequence of the enlargement of  
the joints, and that the muscles are the  
Althumes of the Bones, that most of their  
tendons undergo a considerable  
So we find Bursa & Muco entirely disposed to  
lessen the friction whenever a tendon is  
subject to motion We almost certainly  
find such a Bursa, and they are more  
numerous than Alboicus has represented.  
So whenever a tendon near to y<sup>e</sup> Joints  
of the Wrist or Ankle passes thro a sheath,  
there is within it a Bursa muco, not  
only is the sheath smooth, but there is  
one of these with all its apparatus to  
be found, & without any communication  
with the neighbouring parts. In the  
Rheumatism I have found this Bursa  
distended with liquor, & producing  
Pain. With respect to the Degree of  
Danger which may attend y<sup>e</sup> opening  
of



of the Budge, I imagine it will be nearly  
the same as that which attends the  
Incision made into Ligaments, for there  
is a great agreement in their structure,  
We find a similar Membrane, and in  
some of them, as at the Heel, we find  
Glands for the secretion of a semi-liquid.  
So you should have this circumstance in  
your view.

Next, We would attend to accidents  
to which our muscles & tendons may  
be subject. We all know they are some-  
times lacerated as well as cut, by common  
accidents, but give a wrong notion is  
entertained concerning the laceration, &  
about its cause, which prevents Surgeons  
from examining such accidents properly  
and sufficiently. As when the Tendo  
Achillis is broke, or the tendon about  
the knee torn, just as it is supposed that the



The Stricture is owing to the weight of  
 the body bending the joints suddenly,  
 and that may contribute, but you are  
 to consider the Stricture as chiefly depending  
 upon the effort which the muscle itself  
 makes; so the belly of the Muscle may  
 be as subject to Stricture as its tendon;  
 one parcel of fibres may act with too  
 great violence & tear itself by its sudden  
 action, and without attending to this,  
 the Surgeon only expecting to find it in the  
 tendon may overlook the Stricture in  
 the ~~tendon~~ <sup>belly</sup> of the Muscle. Therefore, as  
 in such cases the cure is made by  
 keeping the ends joined together, so it is  
 of the greatest consequence that we should  
 understand the origin and insertion  
 of the Muscle, and the manner of  
 bending the Joint, so as to relax it  
 to the utmost.

Next,



And, Whenever a tendon makes a turn  
 it is held down by a sheath, and here the  
 difficulty is greater, for by keeping of body  
 in one posture, the tendon may grow to  
 the sheath, so that a degree of motion is  
 necessary, which will require of judgment  
 of the Surgeon. In like manner, sheath  
 may be torn, and the same caution  
 will be necessary. So My Father used  
 to mention a case of this kind in the  
 late Duke of Argyle who by a sudden  
 effort had the sheath lying down the  
 tendons of the Peronei muscles torn, so  
 that a tendon started out behind the  
Tibula, and whenever the Muscles got  
 a wrong direction they were thrown  
 into a spasm. — Now if such a case  
 be properly taken care of, a new sheath  
 may form, or when it is neglected W.  
 And —



515. Endeavour by an artificial Compression  
to confine the tumour to its place

Next, We may observe, what is peculiar to  
any of the Scirrhi; I think it unnecessary to repeat  
the Operations I made concerning it. Pelvis.  
We find the cavity for the thigh bone, somewhat  
thick & strong above and that the bottom where  
the gland is lodged is transparent, so if it is  
injected, & matter forms in the cavity, it may  
make its way into the Pelvis, before it can  
conquer the Ligaments. In such a case therefore  
if the Disease can be discovered by any  
certain mark, we could open the Ligament  
near the bottom of the ferix, avoiding the  
large Vessels & Nerves which pass over the  
Ball.

I shall show the Situation of this Scirrhus, but  
you will have in your view the position of  
the ferix, as where it happens the kind is  
shorter, as when the Tumor is located on the  
back of the Pelvis, but we distinguish from  
the Cell remaining in the neck, and

on



on making a rotation we do not feel the  
ball rolling under the glutei muscles, and  
lastly we judge from the nature of, accident  
& the length of the part, and after  
we have drawn the limb to its proper  
length, it immediately goes back in its position,  
without being taken carefully prevented.

At the joint of the knee we find always  
two, sometimes three distinct cavities. Viz, a  
Bursa Musca above, and another below the  
Patella, and beneath these the cavity of the  
Joint. Now, tho' there is a resemblance between  
these cavities, the opening of the Bursa musca  
is probably not so dangerous, & when matter  
is collected here we find out a difference by  
examining the progress of the Tumour, and  
if it is above or below it will be small and  
the Patella will not be raised forward;  
But if it is in the Joint, upon making a  
suppuration, we feel the Patella in motion,  
and raised on the Tumour. Next we find



51<sup>4</sup> found a vast shingle of Ligament around  
this Joint, so that we could scarce suppose a  
Luxation here curable; but in fact I have  
met with several cases where the whole  
Knee was disjoined, & which were perfectly  
cured. There is another kind of Luxation,  
Intreating which I have seen some very good  
Surgeons Monstrous That of the Patella; in  
one case of this kind, a Man of about 24  
Years of age, & remarkably tall, as he was  
throwing a spear of some well, a fork, slipped  
his foot, and was sensible of some part of  
the Knee going out of its place, and was  
unable to make any motion; The Surgeons  
found the Bone in the very posture in  
which it remained Three days before.  
I saw then, the inner side of the Patella lay  
against the outer side of the Femur, and  
we saw the shape of the Patella thro  
the Skin distinctly. I concluded with the  
late Mr. Astruc, that the Surgeons had  
not



not taken care to disengage the bone by drawing it forward tho' they had used considerable violence, I was endeavouring by a stroke to beat it into its place: accordingly Mr. Aldie set to work, & placed himself as Surgeons always do upon the inner side, then taking hold of the Patella, he pulled with all his strength, but found it to no purpose upon account of the cause of this, it occurred to me that it was impossible to press in the finger so much as to raise the inner side of the bone, so I placed myself on the opposite side, & pushing it back with all my force, in an instant the bone turned round & went into its place."

Next, under this articulation we have seen a number of muscles inserted, which are said to affect the leg. We are carefully to preserve them, for the Joint growing stiff they become muscles of the thigh.

In the ankle we have seen a motion  
 Cont



519. Confined to Two Questions, Flexion and  
Extension, so the Arguments are weakest before  
and Motion, Where therefore a Luxation  
happens here, The Leg either slides forward  
on the foot, or the Heel forward on the Leg,  
and by comparing the two feet together, We  
readily distinguish this; The Luxation too  
may be reduced with ease, & the motion  
of the part tolerably well restored.

The Rotatory motion of the foot, is put  
on the end of the Peroneus, and it is very  
material to attend to this in Distortions  
of the foot, for if the Surgeon supposes that the  
Rotation is on the joint of the Ankle, it is  
necessary the bandage should grasp the Leg.

As to the Seasoned bones which  
you saw partly in the foot, We may consider  
the Patella as one of the largest of them, and  
we need only to determine the use of it  
to understand the use of all the rest.  
First, It is a protection to the joint, that a



But does not so soon enter it; Next, it seems for the insertion of tendons, or in the foot is made for allowing tendons pass over them, that the tendon may be thrown at a greater distance from the focus of the joint, and its summation enters the Tibia at a greater angle, so that the force of the muscle is increased.

As I observed that our Tendons are here moved by the effort of the Muscles, the Patella may be seen in like manner, so I met with a Case, where the Cupra had the Patella, fractured by stepping a foot, and again striking the knee on the ground, the Bone in the Mexican wanting a solid support, snapped on the end of the thigh bone — After these remarks upon the last joint the only thing remaining is to mention a combination of the Muscles in walking or let us consider the manner in which the step is made, which is but a very gross path even if we take but the outlines of it —



521. I place myself between my two feet, and I'll  
suppose that I mean to make a step with my  
left foot, or weight falling between the feet, before  
I step one, I must throw my whole weight  
upon the other, therefore the first thing I do  
is to throw into action the muscles of the  
side with the Abductors of the thigh, in order  
to draw the weight over, and to roll the  
Pelvis upon the top of the Femur. I now  
stand suspended & firm, upon my right leg,  
then acting with the Flexors of the thigh  
of my left leg & as the same time with  
the Flexors of the leg itself in order to bend  
the thigh and the leg likewise a little in order  
to lift it. — But next, as I am straight  
upon one leg, & the other is standing from  
my body, before I can bring the left leg to the  
ground, after lifting it, I must necessarily  
allow the joints of the right leg to yield  
a little. So I act with the Extensor muscles  
of the knee, yet they are elongated, as I  
allow



57A  
allow them <sup>knee</sup> to bend, and now I try to bring  
the weight of the body forward, and I begin  
with the flexors of the thigh, which acting  
on the right side draw the trunk forward,  
Next, I mean to pull it further, and I will  
employ the Extensors of the Leg, for it being  
fixed they raise the thigh upon it, and  
bring it forward. In order to push it still  
further forward, I act with the Gastrocnemius  
muscles, at the same time I keep in action  
the Extensors of the Leg. And as the Gonelli  
muscles cannot go inward, because of the  
action of the Extensors the heel is raised and  
my weight thrown further forward, on the  
arch of the foot, Next by repeating I draw the  
weight between the two legs, & gradually  
bring the whole body upon the left foot  
to make the second step, when I make  
a repetition of the same action, but with  
a greater swing of the Leg. —

In order to sum, I only differ in this, that  
by



By an instinct of Nature I do not trust to the narrow basis, but keep the feet more asunder, tho' that the body is more spread in running.

In order to Jump, I act with both Legs at the same time, and to feel the muscles for their action, I stretch them, I allow the Joints to bend, and drawing the power into my muscles as one, I press strongly against the Earth; and as the reaction is equal to the action I catch, I am thrown from the earth with considerable force; The same as if I had been standing on the soles of another person, and he had made the effort; Or it is the same whether the Earth reacts, or we do it with our own bodies.

End of the Second Volume

D. Linn

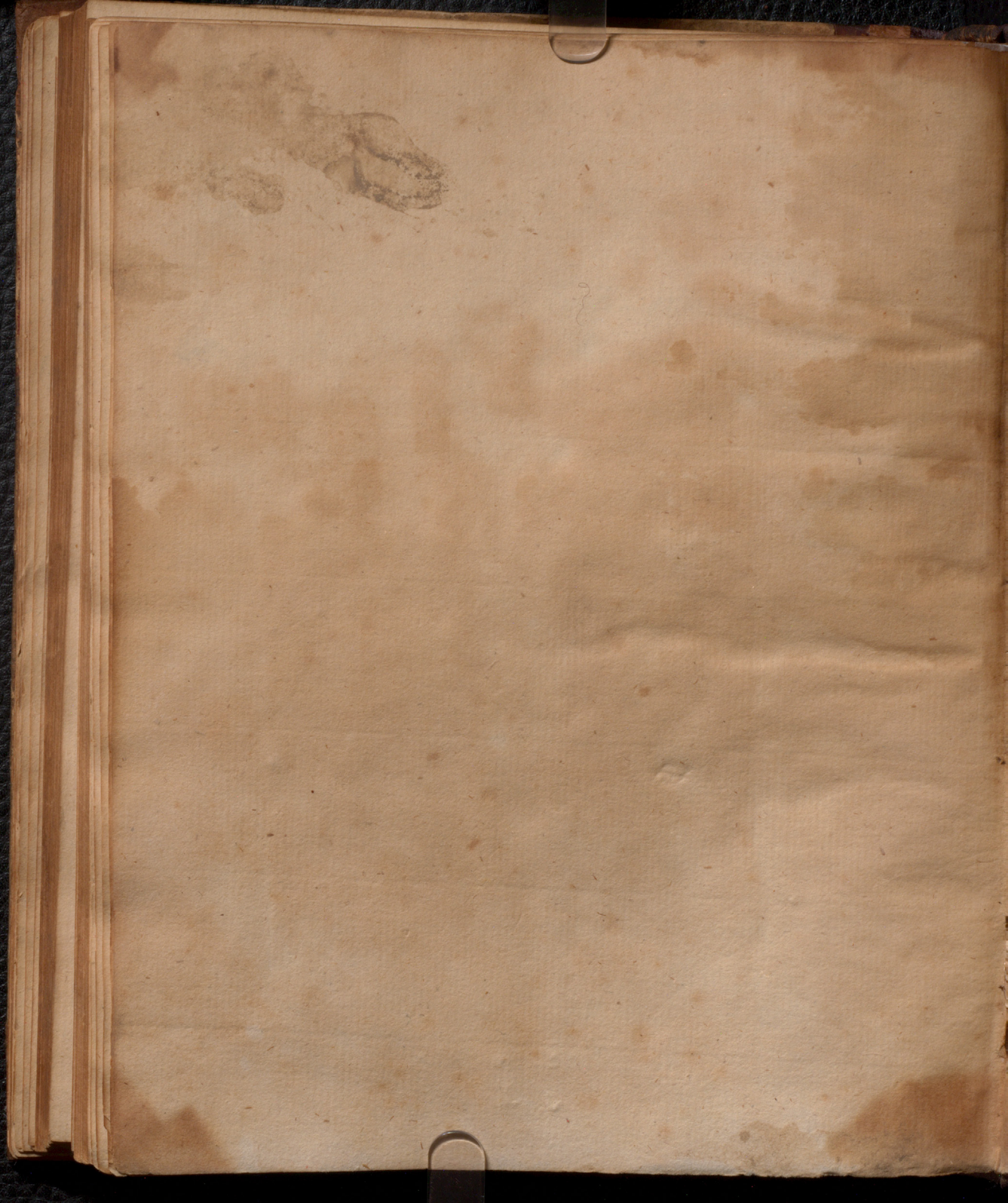


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